

1. On the Classification and Distribution of the Æluroidæ.

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The Proceedings of this Society contain three papers, of progressively increasing importance, on the classification of the order Carnivora. The first of these is a paper by Mr. Waterhouse¹, wherein he proposes to divide the order into six coordinate families, named by him *Canidæ*, *Viverridæ*, *Felidæ*, *Mustelidæ*, *Ursidæ*, and *Phocidæ*. These divisions are based on cranial and dental characters. He associates *Arctictis* with *Procyon*, *Nasua*, *Cercoleptes*, *Ailurus*, and the Bears in his *Ursidæ*; and adds in a note, "from an examination of the external characters of *Bassaritis astuta* it appears to me that it belongs to this group." As to the true Bears, he remarks that they differ from the other terrestrial Carnivora "in having a projecting process on the underside of the ramus, and situated a little in advance of the angle of the jaw. The same character is also found in many Seals (*Phocidæ*), which, in several other respects, appear to approach the Bears."

He expresses the opinion that "the Cats appear to bear the same relation to the *Mustelidæ* as the Dogs to the *Viverridæ*." As to the last-named family, he tells us "the *Viverridæ* have the same general form of skull as the *Canidæ*, but differ in having the posterior portion more produced; the bony palate is carried further back; and the small back molar observable in the lower jaw of the Dogs is here wanting." The *Hyæna* he is "inclined to regard as an aberrant form of the *Viverridæ*;" adding, "in the general characters of the cranium, and especially in the curved form of the lower jaw, it differs considerably from the Cats, and approaches the *Viverras*. If, however, it be placed with the *Viverridæ*, it will form an exception as regards its dentition, having only one true molar on either side of the upper jaw. The 'carnassière' has a large inner lobe, and in this respect also resembles the *Viverras*, and not the Cats."

The second paper I have referred to is that by the late Mr. H. N. Turner², wherein he refers to, and much further elaborates the views propounded in, Mr. Waterhouse's paper, but objects to a division of the order into six groups of similar rank. He divides the terrestrial Carnivora into three primary groups, to each of which he gives the rank of a family, namely (1) *Ursidæ*, (2) *Felidæ*, and (3) *Canidæ*. The first family he divides into the three subfamilies *Ailurina*, *Procyonina*, and *Mustelina*, classing *Bassaritis* in the second of these, and saying³, "from the characters presented by the cranium, I do not feel the slightest hesitation in referring this animal

¹ P. Z. S. 1839, p. 135.² "Observations relating to some of the Foramina at the base of the Skull in Mammalia, and on the Classification of the Order Carnivora," P. Z. S. 1848, p. 63.³ *Loc. cit.* p. 81.

to the subursine section. It is true that the teeth have some resemblance to those of *Viverræ*; but this only results from the greater or less development of different cusps, being an adaptation to a more carnivorous diet."

He observes, as to *Proteles*¹, that it "has the cranial characters common to the Cats and Hyænas: from the dentition, so singularly modified by arrest of development, but little evidence of zoological affinity can be adduced; I should therefore be rather inclined to consider it a modified Hyæna, since in the external characters it so closely resembles the animals of that genus." As to the Hyænas themselves, he declares himself disposed to consider them, judging from their cranial characters, as rather more approaching the Cats than the *Viverræ*, but proposes to obviate the difficulties thus arising by a division of his family *Felidæ* into three subfamilies, one for the Cats, another for the *Viverræ*, and the third for the Hyænas and *Proteles*.

The characters and subdivisions of his family *Felidæ* are expressed as follows² :—

Fam. FELIDÆ.

Auditory bulla rounded, frequently showing indications of being divided into two parts.

Paroccipital process flattened, and applied to the back part of the auditory bulla.

Foramen condyloideum more or less concealed. Foramen glenoideum very small or wanting.

Cæcum small or moderate, simple. Cowper's glands present. Prostate gland salient.

Subfam. VIVERRINA (confined to the Old World).

A distinct alisphenoid canal (with very few exceptions).

Auditory bulla distinctly subdivided.

Canalis caroticus distinct, though sometimes only as a groove.

True molars on each side $\frac{2}{2}$.

Galictis.

Ryzæna.

Cynictis.

Herpestes.

Arctictis.

Cynogale.

Paradoxurus.

Prionodon.

Genetta.

Viverra.

Subfam. HYÆNINA (confined to the Old World).

No alisphenoid canal.

Division of auditory bulla scarcely perceptible.

Canalis caroticus indistinct, or very small.

True molars on each side $\frac{1 \text{ or } 0}{1}$; premolars on each side $\frac{4}{3}$.

Proteles.

Hyæna.

¹ *Loc. cit.* p. 82.

² *Loc. cit.* p. 86.

Subfam. FELINA (of general geographical distribution).

No alisphenoid canal.

Division of auditory bulla slightly or scarcely perceptible.

Canalis caroticus indistinct or not perceptible.

True molars on each side $\frac{1}{1}$; premolars on each side $\frac{3}{2}$.

Felis.

The genus *Arctictis* is placed in the above list amongst the *Viverrina* without any observations in the text. It should be noted that this subfamily is divided, by horizontal lines, into three sections, the two genera *Genetta* and *Viverra* standing nearest to the *Hyænas*, and *Herpestes* and *Ryzana* remote from them.

Certain genera are not enumerated; and on this subject Mr. Turner tells us¹, "The lists of genera include only those whose crania I have examined; and therefore I must not be considered as rejecting any that I have omitted, nor do I pledge myself to adopt all that are inserted."

The third paper on the classification of the Carnivora is that of our president, Professor Flower². Therein he refers to the paper by Mr. Turner, which he supplements by a number of new and original observations and inferences of great value, intentionally confining his remarks, however, to existing terrestrial (fissipedal) genera. He conclusively establishes the true Procyonine nature of *Bassaris* and the Paradoxurine affinity of *Arctictis*; while as to *Cryptoprocta*, he regards it as the type of a distinct family³, though he considers it "as a perfectly annectant form, as nearly allied to the *Viverridæ* on the one hand as to the *Felidæ* on the other." *Proteles* he also constitutes the type of a distinct family, which he interposes between the Suricates and the *Hyænas*, as he interposes *Cryptoprocta* between the Civets and *Genets* on the one hand and the *Cats* on the other. He fully adopts Mr. Turner's threefold division of the fissipedal Carnivora, but raises each of Mr. Turner's families to the rank of a suborder. Professor Flower's ARCTOIDEA and CYNOIDEA correspond respectively to Mr. Turner's *Ursidæ* and *Canidæ*, while Mr. Turner's *Felidæ* is divided by Professor Flower into the five families *Felidæ*, *Cryptoproctidæ*, *Viverridæ*, *Protelidæ*, and *Hyænidæ*—these five families being united into one suborder, for which he first instituted the term ÆLUROIDEA, the affinities of which are suggested by his diagram⁴ (fig. 1).

The following characters common to the ÆLUROIDEA may be gathered from this paper:—

1. Bulla greatly dilated, rounded, smooth, thin-walled, with one exception osseous, and almost always divided by a septum into two distinct portions.

2. Bony meatus short or with its inferior wall imperfectly ossified.

¹ *Loc. cit.* p. 85.

² "On the Value of the Characters of the Base of the Cranium in the Classification of the Order Carnivora, and on the Systematic Position of *Bassaris* and other disputed forms," P. Z. S. 1869, p. 4.

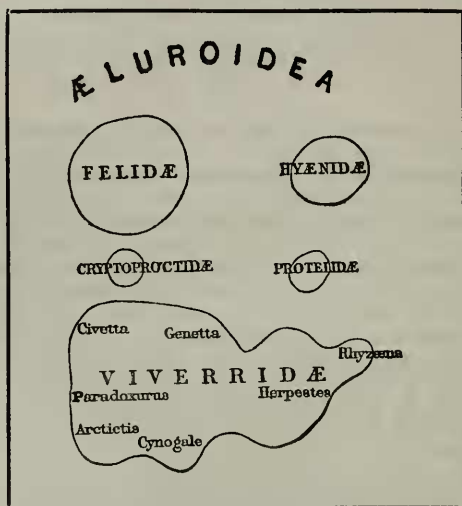
³ *Loc. cit.* p. 23.

⁴ *Loc. cit.* p. 37.

3. Paroccipital process applied to and, as it were, spread over the hinder part of the bulla.

4. Mastoid process never very salient, often obsolete.
5. Carotid canal small, sometimes very inconspicuous.
6. Condylod fissure concealed.
7. Glenoid fissure extremely minute or absent.
8. Cæcum short and simple, very rarely absent.
9. Bone of penis generally small and irregularly shaped.
10. Cowper's gland present.
11. A distinctly lobed prostate.

Fig. 1.



In the above diagram the Herpestine genera are represented as somewhat separated by a constriction from the Civets and Paradoxures. In the text the author tells us¹ "all the Herpestine members of the *Viverridæ* (*Cynopoda*, Gray) present certain common characters of this region by which they can be readily recognized. The bulla is very prominent and somewhat pear-shaped, the larger, rounded end being turned backwards and somewhat outwards; a well-marked transverse constriction separates the two chambers, which are directly anterior and posterior. . . . The Suricate presents the same essential characters in a very modified form."

As to the Hyænas, Professor Flower appears to hesitate somewhat as to whether they should form "a fourth primary division of

¹ *Loc. cit.* p. 20.

the Carnivora, or be added, as rather aberrant members, to the Æluroid section. On the whole," he adds, "I am inclined to the latter arrangement," especially from the support given to it by the genus *Proteles*. As to the characters of that genus, he observes¹:—"In the first place they are thoroughly Æluroid, but they do not exactly agree with either of the families of that group as hitherto defined. On the whole they approach nearest to the Herpestine section of the *Viverridæ*, but deviate from this, and approximate to the *Hyænidæ*, in two points. . . . If Cuvier had called *Proteles* a Hyænoid Ichneumon instead of a Hyænoid Genette, exception could scarcely have been taken to the description."

The object of the present paper is to carry further the examination of the affinities and interrelationships of the genera constituting Professor Flower's Æluroides, and especially to discover what divisions below the rank of families can be most conveniently and naturally established in it. In order to effect this, I have, to the best of my ability, studied the animals living in our gardens, preparations preserved in the Museum of the Royal College of Surgeons, and the skins, spirit-specimens, and osteological treasures of the British Museum, and I have dissected such individuals as good fortune has thrown in my way. I have especially wished to note the cranial characters of such genera as are not referred to in the three papers already noticed, namely the genera *Fossa*, *Prionodon*, *Poiana*, *Hemigalea*, *Arctogale*, *Galidia*, *Galidictis*, *Bdeogale*, *Helogale*, *Cynictis*, *Rhinogale*, *Crossarchus*, and *Eupleres*. I have endeavoured also to ascertain and enumerate such papers and illustrations as may be most useful for reference or may have some historical interest.

It will, I think, be most convenient if I state at once the conclusions I have arrived at as to classification, and afterwards notice, seriatim, the several genera, giving separately the characters and references which refer to each.

In the first place I am profoundly convinced that the great group ÆLUROIDEA is a natural one, and that the Hyænas must, without any question whatever, be included within it. The only doubt is as to their claim to rank as a distinct family, so closely connected do they seem to me to be with the Herpestine group of *Viverridæ*. Anyhow I am unable to divide the suborder into so many primary groups as those of Professor Flower.

I have examined with as much care as I could the skeleton of *Cryptoprocta*, and considered the evidence recorded as to its soft parts, and have come to the conclusion that it is distinctly Viverrine, and not at all unquestionably intermediate, as I at first supposed, between *Viverra* and *Felis*. Its dentition is of course almost feline; but the more I study comparative anatomy, the more impressed I am with the little value of dental characters as evidences of affinity, save as regards allied species or genera. *Nandinia*, *Arctictis*, and *Cynogale* may be cited as evidence of divergences in dental characters from the more normal Viverrine type, to which other structural

¹ *Loc. cit.* p. 29.

divergences do not run parallel. Professor Flower himself has remarked:—"Too exclusive attention has been paid to the characters of the teeth in defining the family divisions of the order. The difficulty in the taxonomic use of these organs arises from the fact that the teeth of all the members of such a limited and well-defined group as the terrestrial or fissipedal Carnivora are formed on the same general type, but with infinite modifications of this type. And as these modifications are mainly adaptive, and not essentially indicative of affinity, they reappear in various degrees and combinations in many of the great natural divisions of the order. Their teeth alone afford us no satisfactory means of diagnosis between the very distinct groups of the *Procyonidæ* and *Viverridæ*. The teeth of *Proteles*, though demonstrating undeniably its right to a place in the order, are so rudimentary or generalized that they afford no help whatever to determine its special position. Again, the teeth of *Gulo* are so similar to those of *Hyæna*, that, if this character alone were used, these two otherwise widely differentiated forms would be placed in the closest proximity. *Enhydris*, among the *Mustelidæ*, and *Cynogale*, among the *Viverridæ*, might also be cited as examples of strangely modified dentition, with comparatively little corresponding change in other parts." I thoroughly agree with every word here cited; and, until unexpected evidence as to the anatomy of its soft parts comes to my knowledge, I must rank *Cryptoprocta* as merely the type of a subfamily of the *Viverridæ*.

As to *Proteles*, the words just quoted from Professor Flower concerning it confirm the previously cited remark of Mr. Turner², that from a "dentition so singularly modified by arrest of development, but little evidence of zoological affinity can be adduced." It differs from the *Hyænas* in having a developed pollex; but such differences occur in the Herpestine section of the *Viverridæ*, yet no one on that account would erect *Bdeogale* and *Suricata* into a distinct family, any more than *Ateles* or *Colobus* amongst the *Anthropoidea*. A careful consideration of the characters of *Proteles* have convinced me that it should be included within one family along with the *Hyænas*; and Professor Flower, in his paper on the anatomy of *Proteles*, concludes³ by saying that, though still "inclined" to retain it in a distinct family, yet his examination of its soft parts shows its affinities with the *Hyænas* "are closer than the examination of the skull alone led" him "to suppose." I would, however, while merging it in the *Hyæna* family, yet retain it as the type of a distinct subfamily of the *Hyænidæ*.

If my views are correct, then the suborder Æluroides will consist of three families—(1) the *Felidæ*, (2) the *Viverridæ*, and (3) the *Hyænidæ*.

As to the first of these families, it is evidently impossible to group any of its existing forms in distinct subfamilies. Indeed, in a recent careful study of the *Felidæ*, I have been quite unable to find satisfactory characters whereby to divide that family into more than the two genera *Felis* and *Cynælurus*.

¹ P. Z. S. 1869, p. 5.² P. Z. S. 1848, p. 82.³ P. Z. S. 1869, p. 406.

It has been proposed to separate off as a distinct genus the Cats with a vertical pupil and an orbit inclosed behind by bone, and to divide the round-pupilled Cats into two genera, according to the presence or absence of a first upper premolar.

These characters do not appear to me capable of serving as marks of generic distinctness. Some Cats—as *F. macrocelis*, *F. serval*, and *F. chaus*—are described as having a pupil neither round nor linear when contracted, but oblong; and while in most of the smaller Cats in which the point has been ascertained the pupil is linear, in some, as *F. eyra*, it is round. The length of the postorbital processes varies even in the same species, and much more in forms which must be connected as close allies; while the morphologically second upper premolar may also be present or absent in the same species, as in *F. scripta*, *F. pajeros*, and others, while in *F. planiceps* it is large and two-rooted. In the skull of an old Lion¹ I have found the upper two molars not only absent, but every trace of their alveoli also. The ears of the Lynxes are pencilled, but those of *F. chaus*, *F. ornata*, and *F. caudata* are more or less pencilled likewise. The Lion stands alone with its large mane (though the Ounce has a small one), and the Tiger is distinguished from every other Cat by its stripes; but these no one would take to be generic distinctions.

We might indeed separate off the Lion, Puma, Jaguar, Eyra, *F. aurata*, *F. planiceps*, *F. badia*, and *F. rutila* as Cats of a uniform colour, neither spotted nor striped when adult. The group, however, would not be a natural one. Similarly, we might associate together the most distinctly spotted Cats, while distinguishing others (as *F. marmorata*, *F. macrocelis*, *F. megalotis*, *F. pajeros*, *F. caligata*, *F. manul*, *F. neglecta*, *F. torquata*, and *F. catus*) as rather “clouded” than “spotted.” Almost every transition, however, exists between the spotted and clouded Cats, and some spotted forms occasionally have their spots very slightly marked; so that generic distinctions reposing on any such characters would be most futile.

It is not the object of this paper to define species; nevertheless the question as to the distinctness of certain of them will have to be occasionally considered. I may therefore perhaps be excused for remarking that I have examined a large quantity of skins of the Lynxes known as *F. borealis*, *F. canadensis*, *F. rufa*, and *F. maculata*, and found amongst them so very many intermediate conditions as to both coloration (ground-colour and markings) and length of fur, that I cannot but regard them as forming but a single species. This opinion is also confirmed by the close resemblance which exists between their skulls.

As to the Lynx *F. isabellina*, I was at first inclined to regard it as a good species; but Dr. Scully has very kindly allowed me to examine the skins obtained by him in Central Asia, and amongst them is one intermediate in coloration between the *F. isabellina* of the British Museum and certain specimens of the Northern Lynx. The Pardine Lynx (*F. pardina*) I am disposed to regard as a distinct species on account of the form of its skull. When the skull is seen

¹ No. 4504A in the museum of the Royal College of Surgeons.

in profile, it differs from the skulls of the varieties *F. borealis*, *F. canadensis*, *F. rufa*, and *F. maculata* in that the part between the orbits is more raised and convex, and the nasal bones extend backwards beyond the nasal processes of the maxillæ.

Considering the length of time during which we have had power in India, it is remarkable that our collection of Indian Cats should be so imperfect as it is. I am, however, not without the hope of being hereafter able to exhibit here a new collection of the skins and crania of these animals. The species known as *F. bengalensis* especially requires investigation, as, if its range of variation both in size and markings is not very extensive, several distinct species must be included under that name.

Amongst African Cats that described by Lesson¹ under the name *F. senegalensis* was probably but a young Serval. There is unfortunately no specimen of it in the Paris Museum; and the type was a cat living at the hospital of Rochefort-sur-Mer. We have as yet, so far as I know, no specimen of *F. colocollo* in this country; and we much need more skins and skulls from America to help us to determine the value of the forms distinguished as *F. tigrina*, *F. mitis*, and *F. macroura*.

The second Æluroid family, the *Viverridæ*, presents a great contrast to the first in the great variety of the forms it contains. Instead of being unable to divide it into subfamilies, the difficulty is to avoid making too many. Two subfamilies, *Viverrinæ* and *Herpestinæ*, must, I think, be instituted for the Viverrine and Herpestine sections of the group. In the former must stand *Viverra*, *Viverricula*, *Fossa*, *Genetta*, *Prionodon*, *Poiana*, *Paradoxurus*, *Arctogale*, and *Hemigalea*. In the latter I would place *Herpestes*, *Helogale*, *Cynictis*, *Bdeogale*, *Rhinogale*, *Crossarchus*, and *Suricata*.

As to *Nandinia*, *Arctictis*, and *Cynogale*, arguments are by no means wanting in favour of the erection of each of these three genera into a distinct subfamily. I hesitate, however, so far to multiply groups of that rank; and I would retain them all, at least provisionally, amongst the *Viverrinæ*.

The genera of this subfamily seem to group themselves in two sets (as was indicated by Mr. Turner²), one set being that of the Civets, the other that of the Paradoxures, as follows:—

A. *Viverra*, *Viverricula*, *Fossa*, *Genetta*, *Prionodon*, and *Poiana*.

B. *Paradoxurus*, *Arctogale*, *Arctictis*, *Hemigalea*, *Nandinia*, and *Cynogale*.

The subfamily *Herpestinæ* seems divisible into two sets—one (A) including *Herpestes*, *Helogale*, and *Cynictis*; while the second set (B) will comprise *Crossarchus* and *Suricata*. I cannot certainly determine to which set *Bdeogale* and *Rhinogale* should belong till more of their anatomy is known.

It is to the latter set that I regard the *Hyænidæ* as specially allied, while *Cryptoprocta* (in spite of its claws and dentition) seems

¹ Guérin's Mag. de Zool. 1839, t. x. (Mammifères).

² P. Z. S. 1848, p. 87.

to me to be not improbably a much modified relative of the first Herpestine series of genera.

There remain the curious Madagascar Viverrines known as *Galidictis*, *Galidia*, and *Eupleres*. I think it better not to include these in either of the foregoing subfamilies, in spite of their greater affinity to the *Herpestinæ* than to the *Viverrinæ*; while *Galidia olivacea* and *G. concolor* seem to me to merit generic distinction, the former being the type of a distinct genus, *Hemigalidia*. The last, with *Galidia* and *Galidictis*, I would include in a separate subfamily, *Galidictinæ*, with which the singularly aberrant *Eupleres* seems to me to be nearly allied; yet, on account of its aberrant characters, I would keep it separate in a special subfamily, the *Euplerinæ*.

According to this view, the Æluroid forms will be grouped as follows:—

Suborder ÆLUROIDEA.

Fam. I. FELIDÆ.

Genera: *Felis*, *Cynælurus*.

Fam. II. VIVERRIDÆ.

Subfam. 1. VIVERRINÆ.

Genera:—A. *Viverra*, *Viverricula*, *Fossa*, *Genetta*, *Prionodon*, *Poiana*.

B. *Paradoxurus*, *Arctogale*, *Hemigalea*, *Arctictis*, *Nandinia*.

C. *Cynogale*.

Subfam. 2. GALIDICTINÆ.

Genera: *Galidictis*, *Galidia*, *Hemigalidia*.

Subfam. 3. EUPLERINÆ.

Genus: *Eupleres*.

Subfam. 4. CRYPTOPROCTINÆ.

Genus: *Cryptoprocta*.

Subfam. 5. HERPESTINÆ.

Genera:—A. *Herpestes*, *Helogale*, *Cynictis*, (*Bdeogale*?, *Rhinogale*?)

B. *Crossarchus*, *Suricata*.

Fam. III. HYÆNIDÆ.

Subfam. 1. PROTELINÆ.

Genus: *Proteles*.

Subfam. 2. HYÆNINÆ.

Genera: *Hyæna*, *Crocota*.

The distinctive characters of the *Felidæ* are:—

- (1) There is a short pollex with a claw not, or hardly, reaching to distal end of metacarpal of index.
- (2) The hallux is only represented by a rudimentary metatarsal bone.
- (3) The ungual phalanges are greatly arched, with a wide lamina to shelter the base of the claw.
- (4) The claws are greatly arched, sharply pointed, and, except in *Cynælurus*, completely retractile.
- (5) The auditory bulla is much inflated, smooth, and rounded, but hardly shows any external sign of division into two chambers.
- (6) The bulla is more prominent towards its inner than towards its hinder border.
- (7) There is an almost complete bony septum between the two chambers of the bulla, which are one behind the other.
- (8) The bony meatus auditorius is short and neither produced anteriorly nor inferiorly; neither is it imperfectly ossified below.
- (9) There is no carotid foramen anywhere visible on the surface of the basis cranii.
- (10) There is no alisphenoid canal.
- (11) The palatine foramina are situated in the hinder half of the palate.
- (12) $\frac{P.1}{P.2}$ and $\frac{P.2}{P.2}$ are not developed ¹.
- (13) There is no lower tubercular molar, no $\frac{M.2}{M.2}$, and no $\frac{M.2}{M.2}$.
- (14) $\frac{M.1}{M.1}$ is always very small and transversely extended.
- (15) The antero-external cusp of $\frac{P.4}{P.4}$ is fairly developed, but is much smaller than the two others.
- (16) $\frac{M.1}{M.1}$ has hardly any talon.
- (17) The outer incisors but little exceed the middle ones in size.
- (18) Humerus with a supracondyloid foramen.
- (19) Bone of penis small.
- (20) The ears not very long, erect and pointed.
- (21) Tarsus and metatarsus hairy.
- (22) One small plantar pad, and one beneath each digit.
- (23) The anus does not open into a saccular depression.
- (24) Two anal glands only.
- (25) No prescrotal glands.
- (26) Always a more or less small cæcum.
- (27) Many very hard, horny, sharp-pointed, conical papillæ on the dorsum of the tongue.
- (28) Hippocampal gyrus not ² completely separated from the antero-

¹ The mandible of a Tiger with $\frac{P.2}{P.2}$, killed in British Burmah, is described and figured by B. A. Lydekker in the Journ. Asiat. Soc. Beng. vol. xlvii, (1878), p. 2, plate ii.

² So far as I have had an opportunity of examining.

- internal portion of the superior lateral gyrus, which is behind the cranial sulcus, by any continuation forwards of the calloso-marginal sulcus to join the crucial sulcus.
- (29) Angle of mandible not greatly flattened beneath, and coronoid process high and inclined backwards.
 - (30) Proportional length of limbs considerable.
 - (31) Muzzle short compared with cranial length.
 - (32) Dentition extremely sectorial.
 - (33) Tail long, moderate, or extremely short.
 - (34) Clitoris never traversed by urogenital canal.
 - (35) Dorsal vertebræ thirteen.
 - (36) Postorbital processes more or less strongly developed, sometimes enclosing orbits by a bony circle.
 - (37) Paroccipital processes not depending, or else only slightly projecting, as a rough tubercle beyond the bulla.
 - (38) Mastoid rather prominent.
 - (39) No carotid foramen perforates or notches the sphenoid.
 - (40) Nose and upper lip medianly grooved.
 - (41) Palate very little or but moderately produced beyond last molars.
 - (42) Pterygoid fossa very small.
 - (43) Size of species generally moderate, never very small, sometimes very large—the largest of the Æluroidæ.

Of the genera of existing *Felidæ*, *Cynælurus* is distinguished from *Felis* by its imperfectly retractile claws and the rudimentary condition of the internal cusp of ^{P. 4}. The characters of the *Viverridæ* and *Hyænidæ* will be given after a brief review of the genera composing those two families.

The typical genus *Viverra* seems to include four species—(1) *V. civetta* (from Fernando Po, Sierra Leone, and Abyssinia), (2) *V. zibetha* (from India, China, and Penang), *V. tangalunga* (from Malacca, Borneo, Sumatra, Luzon, and the Negros and Philippine Islands), and *V. megaspila* (from Malacca, Saigon, and Lower Cochin China).

The anatomy of this anciently-known genus has been described¹ by Perrault in a paper entitled "Description anatomique de deux Civettes," in the 'Memoirs' of the Academy of Sciences of Paris, vol. iii. (1611-1699), with two plates reproduced in a work published by Pierre Mortier, of Amsterdam, in 1736, and entitled 'Mémoires pour servir à l'histoire naturelle des Animaux et des Plantes.' Therein is given a tolerable figure of the external form of the Civet, and representations of the scent-pouch and glands of both sexes,

¹ See also Castellus, '*Hyæna odorifera*, vulgo *Civetta*,' Messonæ, 1638; Bartholin, "Anatome Civettæ s. *Hyæne odoriferæ*," in Hist. Anat. Cent. iv. 1657, pp. 199-213; Méry (Jean), "Observations sur les canaux lactifères de la Civette," in Mém. Acad. Sc. de Paris, 1666-1699; Morand, "Nouvelles observations sur le sac et le parfum de la Civette" (with a plate), Mém. Acad. Sc. de Paris, 1728; and De la Peyronie, "Description d'un animal connu sous le nom de Musc (*Viverra*)," with four plates, Mém. Acad. Sc. de Paris, 1731, pp. 443-464.

with (for the period) a very full account of the structure of the animal. The Civet and Zibet are well figured and described by Daubenton in Buffon's 'Histoire Naturelle,' vol. ix. pp. 299-342, pls. 31 to 35. Anatomical notes on these animals are also given by John Hunter, pp. 51-55 of vol. ii. of his 'Essays and Observations,' collected and published by Professor Owen in 1861. A few notes "On the Internal Viscera of *Viverra melanurus*" have also been published by Hodgson in the 'Calcutta Journal of Natural History,' vol. ii. (1842) p. 56. Recently an account of the anatomy of the Civet, with one plate, has been published by Dr. J. Chatin in the Ann. des Sc. Naturelles, (5th series) vol. xvii. (1873), plate xxiii., wherein the heart and great vessels, the stomach and liver, and the cæcum are represented. Lastly, we have in vol. xix. (1874) of the same work a paper by the same author on the "glandes odorantes des Mammifères," wherein the scent and anal glands of the Civet and Zibet are described and figured (pls. i. and ii. figs. 1-13), and notes are added concerning *Viverra tangalunga*. The external form of the Civet and of the Zibet are given in F. Cuvier's Mamm. vol. ii. The skeleton of the Civet is represented on plate iv. of De Blainville's 'Ostéographie' (*Viverra*), and the skull and dentition of the Civet and Zibet on his plates viii. and xii.; details of the axial and visceral skeleton on plate ix.; and the distal part of the Zibet's humerus on pl. x.

All the four species of *Viverra* agree in having a more or less white throat with transverse, curved, black bands; all have the tarsus and metatarsus hairy beneath, as in the *Felidæ*; all have the back with more or less elongate hair; and all are of large size, the head and body being from about 76" to 92", and the tail from about 31" to 43". *V. tangalunga* is the smallest species, and has been confounded with *V. megaspila*; but the distinctions between the two species have been pointed out by Dr. Günther in the Proc. Zool. Soc. 1876 (pp. 427, 428), wherein is a good representation of *V. megaspila* in both the adult and young condition. The young in this genus seem to be always darker than the adults. The young Civet (judging from a skin in the British Museum) is almost black, with a black tail (whitish beneath its root), and with a greyish mottling on the flanks and outside the thighs, greyish belly, and with white marks on the cheeks, upper lip, inside of ears, underside of throat, and side of the neck¹. I have not seen the skull of *V. megaspila*; but, assuming that it closely resembles those of the other species, it may be said that in *Viverra* the auditory bulla is divided by a distinct groove into a small anterior part and a much larger and more inflated posterior portion. There is an internal septum (as in *Felis*). There is a distinct alisphenoid canal. The paroccipital process depends below the bulla, to which it is applied. The external opening of the auditory meatus is large and rounded; it is rather its

¹ Hodgson, in the 'Calcutta Journal of Nat. Hist.' vol. ii. (1842) p. 55, says that the eyes of the young are open when less than a week old; also that the adults wander about singly and eat small mammals, birds, reptiles, and insects, and some roots.

hinder than its anterior margin which projects most outwards. The carotid artery passes through a distinct canal between the bulla and basisphenoid, the hinder end of which appears as a conspicuous foramen situated a little in front of the middle of the inner border of the auditory bulla.

The orbit is never enclosed by bone; nor is the mastoid at all prominent. The lower margin of the hinder part of the mandible is very concave. The angle of the mandible is long, slender, and backwardly projecting; its coronoid process is not very high or backwardly projecting compared with that of *Felis*. There is a $\overline{P.2}$ and an $\overline{M.2}$. There is also a $\overline{P.1}$ and an $\overline{M.1}$. $\overline{M.1}$ is of large size. $\overline{P.4}$ has a well-developed internal tubercle. The tongue is devoid of horny papillæ or of any patch of conspicuously enlarged papillæ on the anterior part of its dorsum. There is a small conical cæcum. There is a pair of anal glands. There is also a pair of medianly-adjointing scent-glands placed between the penis and testes, or in the analogous position in the female. Their secretion escapes by a number of minute orifices into a large sac, the external aperture of which appears as an antero-posteriorly extended slit simulating a large vaginal aperture.

The genus *Viverra* differs from all the *Felidæ* in that

- (1) The ungual phalanges are less arched, and the bony lamina for sheltering the base of the claw is relatively less deep.
- (2) The claws are less arched and less perfectly retractile.
- (3) The auditory bulla, being ossified, shows external signs of its complete internal division into two chambers.
- (4) There is a conspicuous carotid foramen on the inner side of the bulla, which is most prominent posteriorly.
- (5) The palatine foramina are situated on the anterior half of the palate.
- (6) There is a $\overline{P.2}$ and also an $\overline{M.2}$.
- (7) $\overline{M.1}$ is largely developed.
- (8) $\overline{M.1}$ has a distinct talon.
- (9) The ears are not very long, erect, pointed, or tufted.
- (10) There are no horny, sharp-pointed, conical papillæ on the dorsum of the tongue.
- (11) The hippocampal gyrus is completely separated off from the lateral gyrus by the continuation of the calloso-marginal sulcus forwards to the crucial sulcus.
- (12) The coronoid process of the mandible is less lofty relatively and less backwardly produced.
- (13) The proportional length of the limbs to the body is shorter than even in *Felis eyra*.
- (14) The muzzle is longer in proportion to the cranium.

The genus *Viverra* also differs from the *Felidæ* in that

- (15) There is a distinct hallux with a claw.
- (16) There is an alisphenoid canal.

(17) There is a P. 1.

(18) There are prescrotal scent-glands.

The genus agrees with the *Felidæ* in that

(19) There is a short pollex.

(20) The ungual phalanges are arched to a certain considerable extent.

(21) The claws are arched, sharp-pointed, and somewhat retractile.

(22) The bony auditory meatus is not produced anteriorly or inferiorly, neither is it imperfectly ossified below.

(23) The humerus has a supracondyloid foramen.

(24) The tarsus and metatarsus are entirely hairy.

(25) There is one plantar pad and another beneath each digit.

(26) The anus does not open into a saccular depression.

(27) There are two anal glands only.

(28) There is a small cæcum.

As further characters may be noted that

(29) Rather the posterior than the anterior margin of the external auditory meatus projects the more.

(30) The orbits are not enclosed by bone.

(31) There is no conspicuous foramen on the basis cranii by which the carotid perforating or notching the sphenoid shall re-enter the cranium.

(32) The hinder chamber of the bulla is not everted so as to be external as well as posterior to its anterior chamber.

(33) The palate is not much produced beyond the hinder molars.

(34) The mandibular angle is not everted.

(35) The mastoid is not prominent.

(36) The paroccipital process depends below the bulla, to which it is applied.

(37) The opening of the auditory meatus is rather large and not triangular.

(38) The bulla is narrower in front than behind.

(39) It is not much laterally compressed.

(40) The skull is not greatly constricted behind the postorbital processes of the frontal.

(41) The pollex and hallux reach to the end of the adjacent mid-hand bones.

(42) The scent-glands open into a deep prescrotal pouch or sac.

(43) The median part of the back is marked with black.

(44) The nose exhibits a median antero-posterior groove on its under surface and on the upper lip.

(45) There is an M. 2.

(46) M. 2 is not minute.

(47) The dentition is markedly sectorial.

(48) Hinder part of palate not inclined strongly upwards.

(49) Hinder part of alveolar border of mandible not everted.

(50) Teeth not very small.

(51) No notch in alveolar border of maxilla to receive apex of P. 2.

- (52) There is no plate-like process on the outer side of the radius.
- (53) There is no oval patch of conspicuously-enlarged papillæ on the dorsum of the anterior part of the tongue.
- (54) Ascending ramus of mandible not flattened beneath.
- (55) Tail long.
- (56) Anterior premolars not greatly elongated.

The next genus comprises only the *Rasse*, for which the genus *Viverricula* has been instituted¹ by Hodgson, who says that it differs from species of the genus *Viverra*, which never climb, by its scansorial habit. It is also distinguishable from *Viverra* by its smaller size, smaller snout, and by a very small bald spot on the tibial side of the plantar pad, noticed by Gray² and figured by Hodgson³. The alisphenoid canal is almost always absent; the bulla is, as Professor Flower says⁴, "large, as wide in front as behind, much elongated, narrow, and compressed laterally. The anterior chamber is rather more developed, and less distinctly marked from the posterior." The postorbital processes are longer than in *Viverra*; and the skull is greatly compressed behind them. The paroccipital process does not depend below the bulla. The pollex and hallux are shorter, not reaching to the distal end of the adjoining metatarsal and metacarpal. The character of the dentition is intermediate between that of *Viverra* and that of *Genetta*. $\overline{M}^2$ may have only three cusps. The *Rasse* has a most extensive geographical distribution, having been obtained in China, Foochow, Formosa, Amoy, Gangootra, Camboja, Singapore, Nepal, Madras, Ceylon, Penang, Java, Lombok, Bombay, Socotra, Madagascar, and also from the Comoro Island Anjuan⁵.

The *Rasse* has been described at length, and many interesting details concerning it given, by Horsfield in his 'Zoological Researches in Java' (1824), with a figure of its external form, representations of which will be found in F. Cuvier's 'Mammifères,' vol. ii.; also in Sonnerat's 'Voyage,' vol. ii. p. 144, pl. 91; and in Pollen's 'Faune de Madagascar,' p. 16, pl. 10. Its dentition, both immature and adult, is given on plate xii. of De Blainville's 'Ostéographie' (*Viverra*). Its foot-pads are represented by Hodgson, *Calcutta Journal of Natural Hist.* (1842), vol. ii. pl. 1. fig. iv. As might be expected from its wide distribution, the *Rasse* varies greatly in colour and markings, similarly coloured varieties coming from widely separated localities. There is in the

¹ *Journal of Asiatic Soc. of Bengal* (1841), vol. x. part 2, p. 909. See also Gray, *P. Z. S.* 1864, p. 513, and *Brit. Mus. Cat. of Carnivora* (1869), p. 47.

² *Brit. Mus. Cat.* p. 47.

³ *Calcutta Journal of Nat. Hist.* (1842), vol. ii. pl. 1. fig. iv.

⁴ *P. Z. S.* 1869, p. 18.

⁵ The animal from this island has been described and figured by Dr. Peters in his 'Mossambique.' Dr. Gray threw out the suggestion that this individual might be of the genus *Fossa*; but Dr. Peters has been kind enough to inform me that such is not the case, but that it is identical with Pollen's *Viverra schlegeli*, which appears to me to be a variety of the widely diffused *Viverricula malaccensis*. Dr. Peters remarks to me:—"If not identical with, it is very near that species."

British Museum a light-yellow skin from Candy, and one from Nepal, which is but little darker. Generally the ground-colour is greyish, brownish, or yellowish, and there is a tendency to the development of black bands on the middle of the back and loins, black spots on the flanks, and rings on the tail. The young are very dark, but not so much so as are the young Civets, and they also want the white markings of the latter. The scent-gland is formed as in *Viverra*. Length of head and body about 61", of tail about 38".

The genus *Viverricula* agrees, then, with the genus *Viverra* in all the characters before enumerated, except numbers 16, 24, 36, 38, 39, 40, and 41.

The genus *Fossa* is represented in the national collection by four skins, two skulls, and a skeleton. The genus was instituted by Dr. Gray¹ on the strength of Daubenton's description; and though it seems nearly allied to the *Rasse*, its generic distinctness should, I think, be maintained, at least till its anatomy is more fully known, especially that of its glandular structures. I could not find evidence of a scent-pouch in the British-Museum skins. Neither could Daubenton in his specimen; and M. Poivre (who sent Buffon the stuffed skin described in his work) wrote on the subject as follows:—"La Fossane que j'ai apportée de Madagascar, est un animal qui a les mœurs de notre fouine; les habitants de l'île m'ont assuré que la fossane mâle étant en chaleur, ses parties avoient une forte odeur de musc. Lorsque j'ai fait empaillé celle qui est au Jardin du Roi, je l'examinai attentivement, je n'y découvris aucune poche, et je ne lui trouvai aucune odeur de parfum." Not improbably there are some subcutaneous scent-glands, but no pouch or even deep cutaneous fold in connexion with them.

The limbs are slender; and there are the very small bald places (to which Mr. Oldfield Thomas was kind enough to call my attention) beneath the hind foot. One of these is a little above the plantar pad, very near the small hallux (the claw of which may be wanting in the adult), and the other beneath the distal part of the tarsus, slightly nearer to the peroneal margin of the limb. Another noteworthy character is the absence of any median dark mark on the back. The adult may be very little striped or spotted, with only some spots on the flanks and some obscure stripes on the shoulders; but the young is very distinctly striped; yet even in the young there is no median dorsal stripe, but the central portion of the back is of the general ground-colour, bounded by two rows of small irregular spots, external to which are three strongly marked longitudinal stripes on each side. The black throat-bands (which exist in *Viverra*) are entirely absent. The tail is spotted, the spots tending to form, but not actually forming, rings.

The length of the head and body is about 43"², that of the tail 20"³.

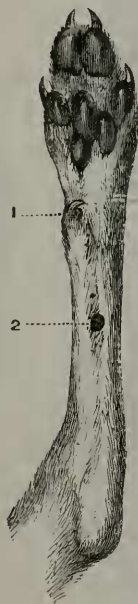
The *Fossa* is only known as an inhabitant of Madagascar. Its external form is figured, and the animal is described, in Buffon, vol.

¹ P. Z. S. 1864, p. 518.

xiii. p. 163, pl. 21. It is also described and well-figured by Dr. Gray, in Proc. Zool. Soc. 1872, p. 869, pl. 74, with a woodcut of the skull, which is long and narrow, approaching *Viverricula* in this respect.

The bulla is shaped much as in *Viverra*; there is a distinct alisphenoid canal; the paroccipital process depends a little below the bulla. There is, on the skull, a deep antero-posteriorly directed groove along the middle of the dorsum of the forehead and muzzle. The

Fig. 2.



Plantar surface of left pes of *Fossa*.

1. Small pad adjacent to hallux; 2. Ditto beneath distal part of tarsus.

postorbital processes are not so elongated as in *Viverricula*. The teeth closely resemble those of *Viverra*; but the talon of $\overline{M}_1$ is rather smaller; $\overline{M}_2$ has five cusps, three in front and two behind. *Fossa* therefore agrees with *Viverra* in all the characters of the latter genus before enumerated, except sometimes No. 15, possibly No. 18, and certainly Nos. 24, 38, 39, 40, 42, & 43.

The genus *Genetta* consists apparently of five species, distributed

as follows :—*G. vulgaris* (from the south of France, Spain, North Africa, and Western Asia at Mount Carmel), *G. felina* (from South Africa, including the Cape), *G. senegalensis* (from Africa, East, West, and North), *G. tigrina* (from South Africa, Abyssinia, and Whydah), and *G. pardina* (from West Africa and Fernando Po).

Thus the genus is essentially African, sending one species on to

Fig. 3.



Pads of *Genetta tigrina*.

A. Palmar surface of left manus; B. Plantar surface of left pes.

Europe and Western Asia; while *Viverra* is mainly Asiatic, but has one species exclusively African. In *Viverricula* and *Genetta vulgaris* we have the only species common to Asia and Africa.

The two groups the Civets and Genets certainly merit to rank as distinct genera; for, in addition to uniformly smaller size and the distinction of geographical range of the latter, they have certain distinctive cranial, dental, and external characters. Thus, instead

of the tarsus and metatarsus being hairy as in *Viverra* and *Viverricula*, or with the small bald spots as in *Fossa*, there is a long, narrow bald strip of skin running up beneath the median part of the metatarsus, towards or to the tarsus. This bald strip, however, is separated from the plantar pad by an intervening hairy portion; and the toes are hairy beneath at the sides. A hairy patch in the manus also separates the proximal part of the palmar pad from its distal portion. All the Genets are of a brownish-yellowish or greyish tint, with black or brown spots on the flanks, and a black line in the middle of the back (thus differing from *Fossa*). There are brown or black stripes behind the ears, extending downwards and backwards over the shoulders. The paws are blackish or whitish; the belly is light-coloured with a few spots; and there is a lightish patch over the eye, and a white spot beneath the eye, separated by a black mark from another white spot beside the nose. The tail is ringed with black.

The characters of skull and teeth by which the Genets differ from the Civets and the relations of this kind presented by *Viverricula* and *Fossa* are as follows:—

The auditory bulla in *Genetta* is not so triangular in form as in *Viverra*, but more equal in width anteriorly and posteriorly, as we have seen to be the case in *Viverricula* (where it is also more laterally compressed); but in *Genetta* the anterior part is more swollen and bullate. The alisphenoid canal is constantly present in *Genetta*, but is small in calibre. In both *Genetta* and *Viverricula* the auditory opening is relatively larger than in *Civetta*. The par-occipital process, which descends down below the bulla, is a depending process in *Viverra*¹, and slightly so in *Genetta*, but does not so extend at all in *Viverricula*. In the last named the skull is extremely compressed behind the postorbital processes, its breadth there being to the total cranial length as but 11·5 to 100, instead of 14·1 as in the Civet, 14·4 as in *Fossa*, and 18·7 as in *Genetta*.

In all the four genera *Viverra*, *Viverricula*, *Fossa*, and *Genetta* the alisphenoid canal is generally (even in *Viverricula* when it is present) long, its hinder opening being often in close proximity to the foramen ovale, the opening of that foramen and the hinder aperture of the alisphenoid canal appearing respectively at the hinder and anterior ends of a common depression in the cranial surface.

The teeth of *Genetta*² differ from those of *Viverra* in that M.²

¹ Very slightly so in *V. tangalunga*.

² As *Genetta* appears to be (at least after *Prionodon*) the genus of existing *Viverride* which comes nearest to the *Felida*, it may not be useless to denote precisely the differences between the permanent and milk dentitions of the Genet and the Cat.

In the Genet the outermost upper incisors are larger in proportion to the innermost (length as 3 to 2). Each outermost lower incisor has a bilobed crown with nearly equal lobes. The canines are relatively shorter, not longitudinally furrowed. The upper canine compared with the base (*i. e.* with the interval between the basion and ovalion) taken at 100, is 46·1 in the Cat, 42·8 in the Genet. By "ovalion" I mean the centre of a horizontal line connecting the hindmost points of the margins of the oval foramina.

is (in general, but not in *V. tangalunga*) relatively larger and more obtusely triangular or even nearly quadrangular, and is more nearly equal in size with the tooth in front of it; $\frac{M.1}{M.1}$ has a relatively larger

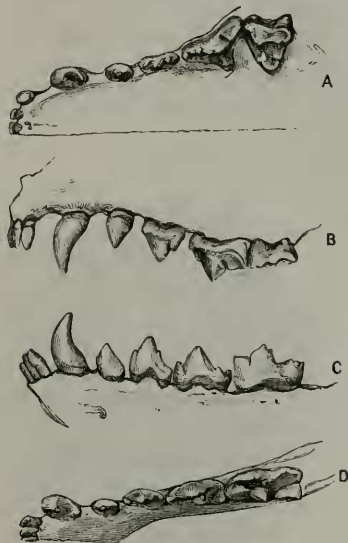
The following teeth, which are absent in the Cat, are present in the Genet:— $\frac{P.1}{P.1}, \frac{M.2}{M.2}, \frac{P.1}{P.1}$ are one-rooted. The second upper premolar, $\frac{P.2}{P.2}$, which is one-rooted in the Cat, is two-rooted, as is also $\frac{P.2}{P.2}$. $\frac{P.3}{P.3}$ has its crown more triangular than the Cat's, the heel (or talon) being smaller. $\frac{P.3}{P.3}$ is much like that of the Cat. The upper sectorial $\frac{P.4}{P.4}$ differs from the Cat's in that its anterior outer cusp is smaller, its third outer cusp, or talon, distinctly bilobed, and its inner cusp larger and more produced from the general surface of the tooth. The homologous lower tooth, $\frac{P.4}{P.4}$, is very like that of the Cat. The first upper molar $\frac{M.1}{M.1}$ is very much larger than that of the Cat; its antero-posterior extent compared with that of $\frac{P.4}{P.4}$ taken at 100, is in the Genet 37·5, in the Cat, at most, only 30·0; its transverse diameter compared with that of $\frac{P.4}{P.4}$ taken at 100 is in the Genet 140·0, in the Cat only 80·0. Moreover it has three roots instead of only two as in the Cat. Its functional surface is trihedral and presents two outer and one inner cusp, with an external cingulum, which is very prominent at the outer anterior angle of the tooth. Between this and the two outer cusps is a flattened somewhat elevated (the skull having the basis cranii upwards) surface. $\frac{M.2}{M.2}$ is shaped like $\frac{M.1}{M.1}$, but is very much smaller. The lower sectorial tooth, $\frac{M.2}{M.2}$ (the analogue, but not the homologue, of the upper sectorial), has a much larger heel than has that of the Cat, and one which is divided into an inner and an outer cusp. There is also a distinct internal cusp, which is placed opposite to the principal external cusp. $\frac{M.2}{M.2}$ is a much smaller tooth than $\frac{M.1}{M.1}$, and is generally quadrate or quadricuspidate, but may be trihedral, with two cusps in front and one behind.

Of the milk-dentition I have not seen the first upper and lower deciduous molars. The second upper deciduous molar, $\frac{D.2}{D.2}$, has a rather more developed prominence, both in front and behind the main cusp, than has the tooth which replaces it. It is therefore very unlike that of the Cat, which is a small simple one-fanged tooth. The second lower grinder $\frac{D.2}{D.2}$ is like $\frac{P.3}{P.3}$; but its talon is larger and is distinctly divided. This tooth is not developed in the Cat. The deciduous upper sectorial, $\frac{D.3}{D.3}$, agrees with that of the Cat in being quite unlike the tooth which replaces it, and in resembling $\frac{P.4}{P.4}$. It differs from the permanent sectorial (as is the case in the Cat) in that the inner cusp is relatively smaller and nearer to the antero-posterior middle of the tooth. A slight ridge extends from this inner cusp to the anterior cusp; and on this ridge a very small fourth cusp is developed. The homologous lower tooth $\frac{D.3}{D.3}$ is like $\frac{P.4}{P.4}$, but has a relatively larger talon, thus resembling the Cat's $\frac{D.3}{D.3}$. The hindmost upper milk-molar $\frac{D.4}{D.4}$ is quite like $\frac{M.1}{M.1}$, though not nearly so antero-posteriorly extended as is the deciduous upper sectorial; it is (as in the Cat) larger in relation to it than is $\frac{P.4}{P.4}$ to $\frac{M.1}{M.1}$. The inferior deciduous sectorial $\frac{D.4}{D.4}$ is quite like $\frac{M.1}{M.1}$, except that the antero-external cusp is much smaller than that immediately behind it. In this difference it agrees with the Cat's $\frac{D.4}{D.4}$, but it has not that excess of talon compared with $\frac{M.1}{M.1}$ which $\frac{D.4}{D.4}$ has

internal portion, while in both $\overline{P.4}$ and $\overline{M.1}$ the talon is larger, that of $\overline{M.1}$ (if not that of $\overline{P.4}$ also) bearing three small cusps¹.

$\overline{M.2}$ is quadricuspidate, and may be quinquecuspidate. The milk-teeth of *Viverra* differ from those of *Genetta* in that $\overline{D.2}$ has a less

Fig. 4.



Milk-teeth of *Viverra civetta*, No. 4265, from Coll. Surg.

- A. Grinding-surface of teeth of right side of upper jaw. B. Side view of teeth of upper jaw. C. Ditto of those of lower jaw. D. Grinding-surface of lower jaw.

developed prominence in front of the main cusp ; $\overline{D.3}$ is less extended antero-posteriorly in proportion to its transverse diameter ; it has its posterior lobe smaller and undivided, and has a more strongly developed ridge running from the inner to the anterior cusp, with

in the Cat. The proportion borne by the length of the upper molar series compared with the base at 100, is in the Genet 128.5, in the Cat 88.4. The length from the front of the lower canine to the hinder side of $\overline{M.1}$, compared with the length from the canine to the hinder surface of the mandibular angle at 100, is in the Genet 63.6, in the Cat 50.7.

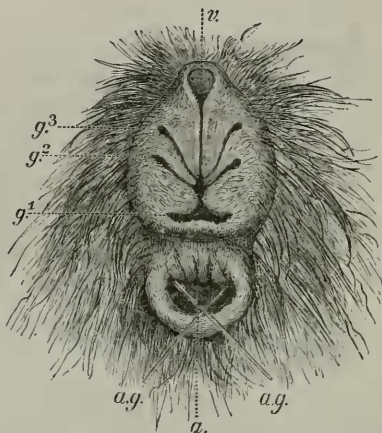
¹ Well shown in *Viverra zibetha*, pl. xii. of De Blainville's 'Ostéographie' of the Viverras.

the accessory tubercle on that ridge larger; $\overline{D.4}$ is the largest deciduous tooth, and nearly as extended antero-posteriorly as is the $\overline{D.3}$; finally, $\overline{D.4}$ has a larger talon, which by itself constitutes nearly half the tooth.

The external form of the Genet is figured by Buffon, and three kinds ("de Barbarie," "de Sénégal," and "panthérine") by F. Cuvier in his 'Planches des Mamm.' De Blainville (*Ostéographie, Viverra*) gives the skull (plate viii.), details of the axial skeleton (plate ix.), and of the appendicular sketeton (plates x. and xi.).

A very important difference between *Genetta* and *Viverra* consists in the absence in the former of the pouch or sac for storing the

Fig. 5.



External appearance of cutaneous folds related to the prescrotal scent-glands of the female of *Genetta tigrina*.

a. Anus. a.g. Needles inserted into the aperture of the two anal glands. g^1, g^2, g^3 . Folds of scent-gland. v. Vagina.

secretion of the scent-gland. Instead of this I found, in a female *Genetta tigrina*, only a shallow cutaneous fold or longitudinal median depression. This groove or fold extended from the small orifice of the vagina towards, but not nearly to, the anus. From this median superficial depression two longitudinal grooves extended forwards and outwards on either side, whereof the two posterior were the larger. Beneath these grooves were two scent-glands, the product of which could be forced (by squeezing) through a multitude of minute pores into the depressed parts of the folds—the hinder rather than the anterior of the two pairs of diverging ones. Similar glands and folds were found by M. Chatin in the male of *Genetta*.

senegalensis, and have been described and figured by him in the *Ann. des. Sc. Naturelles*, 5^e sér. vol. xix. (1874) pl. iii. fig. 14. These glands were described and figured by Daubenton in Buffon's *Hist. Nat.* vol. ix. p. 343, pls. 36-40. Therein the Genet dissected (a female) is described as having a distinct orifice at the bottom of each lateral depression, leading thence into the interior of the gland; but such is certainly not the case in my *G. tigrina*, any more than in Chatin's *G. senegalensis*, in both of which the secretion had only a multitude of minute pores through which to exude.

The genus *Genetta* agrees with *Viverra* in all the characters of the latter before enumerated, except Nos. 24, 38, and 42; and there are, besides, the differences in size and markings and in the more inflated condition of the anterior part of the bulla.

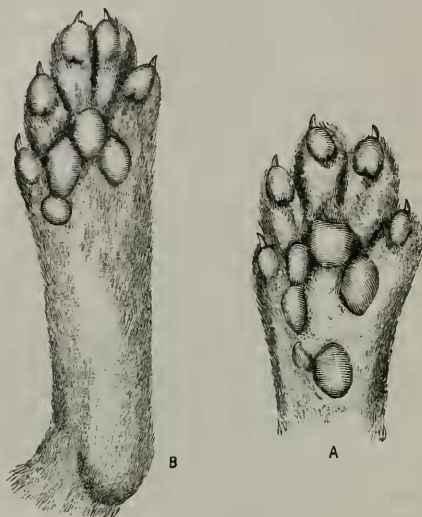
The beautiful Viverrine animals known as the Linsangs differ from the foregoing forms sufficiently to warrant their separation as members of the genus *Prionodon*, which may be said to have been first instituted by Horsfield, since in his 'Zoological Researches' (1824) he proposed for it the term *Prionodontidæ* to denote a subdivision of the genus *Felis*. He there describes it under the name of *Felis gracilis*¹, and gives a representation of its external form, and also separate figures of its head, dentition, and paw. Hodgson, in the 2nd part of the 2nd volume (1842) of the 'Calcutta Journal of Natural History,' p. 57, plate 1, describes a so-called second species of the genus *Prionodon* (*P. pardicolor*); and a third species, *P. maculosus*, has been described by Mr. Blanford in the 2nd part of the 47th vol. of the *Journal of the Asiatic Society of Bengal* (1878), p. 152, pl. 6 (external form) and pl. 7 (skull), the skin and skull of which are deposited in the British Museum, and some points in the anatomy of which I have examined.

In *Prionodon* the ground-colour of the coat is white or whitish grey, with brown or black markings. The markings may form four broad continuous patches running transversely across the hinder part of the body; or spots may replace each continuous patch. The tail is ringed; and there are dark streaks on the neck and shoulders. *P. gracilis* is from Borneo, Java, and Singapore; *P. pardicolor* from Nepal; and *P. maculosus* from Darjeeling, Moulmain, and South Tenasserim. As to size, the length of the head and body seems to average about 46", and that of the tail 40"·5. The fur is soft, close, and erect. The limbs are rather short. The pollex and hallux are both well developed. The claws are almost, if not quite, as completely retractile as in the Cats. The tarsus and metatarsus are entirely hairy. Thus in this respect, as also in the character of the claws and the absence of $\frac{M.2}{2}$, *Prionodon* approaches *Felis* most closely, as Horsfield was careful to point out. The palmar and plantar pads have a greater tendency to break up into separate naked spaces than in *Genetta*; but, as in that genus, a hairy portion intervenes between the proximal and distal parts of the palmar pad. The pupil is circular.

¹ *Prionodon gracilis*, Gray, *P. Z. S.* 1864, p. 519.

As to any scent- or prescrotal gland, Mr. Hodgson says¹:—"Anal gland very apparently present, but the exact character of it not determinable." Horsfield records² of *Viverra*, "Folliculos glandulosos inter genitalia et anum;" but of *Prionodon* he says, "Folliculos supra anum nullos," but with a note of interrogation. The specimen

Fig. 6.

Pads of *Prionodon*.

A. Pads of left manus. B. Pads of left pes.

examined by me was a male. Not only was there no opening in it between the penis and testes, but no glandular structure in that situation beneath the skin could be detected, either by me or by Mr. William Pearson, who assisted me in the dissection. There were the usual anal glands and a pair of exceedingly large Cowper's glands, each of them about equalling in size the whole of the bilobed prostate.

The skull has its general shape and proportions and the form of the auditory bulla much as in *Genetta*. The condyloid foramen is exposed. The paroccipital is neither depending nor prominent, and the mastoid no more prominent than in the Genets. There is a long alisphenoid canal, which opens behind in a depression common to it and to the foramen ovale. The postorbital processes are less marked than in any hitherto; and the skull is antero-posteriorly

¹ Calcutta Journal of Nat. Hist. vol. ii. part 2 (1842), p. 51.

² 'Zoological Researches.'

marked by a groove along the middle of the nasals, as in *Fossa*. The cerebellar chamber of the cranium is very large, larger relatively than in *Viverra* or *Civetta*. The cranial ridges are slight, the temporal ridges not uniting to form a sagittal ridge. The ascending ramus of the mandible has a narrower and more vertically prolonged coronoid process than in *Genetta*, while the angle extends less backwardly. The teeth¹ are formed like those of the Genets, save that there is no $\overline{M.2}$ and that $\overline{P.4}$ has rather a larger talon relatively, while its inner cusp is situated a little more towards the anterior end of the tooth. $\overline{M.1}$ has also a smaller talon than has the corresponding tooth of *Genetta*; and $\overline{M.2}$ is much more minute than is the $\overline{M.2}$ of the Genets, and more laterally compressed, with two (or three) cusps placed one in front of the other. The deciduous teeth are like those of the Genets, save that $\overline{D.3}$ seems to have its talon hardly smaller than in the adult, and has no extra cusp on the ridge joining the inner and anterior cusps. $\overline{D.3}$ is unlike that of *Genetta* and is quite like $\overline{M.1}$, except that the postero-external cusp is rather larger compared with the anterior one, and that the talon is a trifle smaller relatively.

Prionodon has all the characters enumerated as those of *Viverra*, except Nos. 1, 2, 12, 18, 42, 45, and 46.

The genus *Poiana* was founded by Dr. Gray on the *Genetta poënsis* described by Mr. Waterhouse².

Its coloration is very like that of *Prionodon*; but the spots are smaller and show no tendency to run into transverse bands or stripes, except on the middle of the back of the head, and except a broad mark on each side descending from the back of the head to above the shoulder. The tail is ringed with dark rings, alternately broad and narrow. The muzzle is very pointed. The length of the head and body is about 38 inches, that of the tail 40·5 inches.

The animal comes from Sierra Leone and Fernando Po, and differs from *Prionodon* not only remarkably as to geographical distribution, but also in that it has a narrow bald line running up towards the tarsus, as in *Genetta*. I have been able to find no cranial distinctions between *Poiana* and *Prionodon*, save that in the latter the cerebellar chamber of the cranium is smaller, and that the coronoid process of the mandible is intermediate in form between that of *Genetta* and that of *Poiana*.

The teeth are also quite like those of *Prionodon*, except that $\overline{M.2}$ is rather less laterally compressed, its three cusps being not placed so nearly in an antero-posterior line.

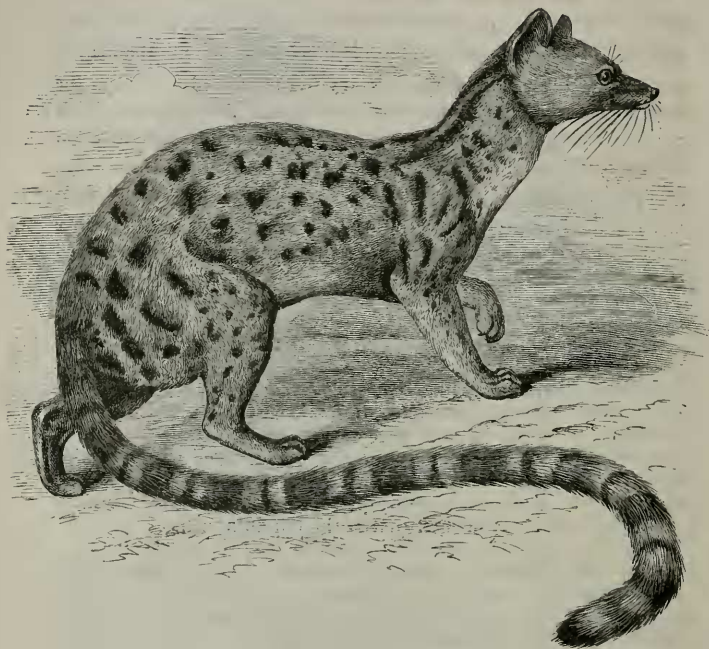
Thus this animal might be considered an African *Prionodon* which had acquired a Genet-like tarsus; and this determination

¹ The dentition (copied from Horsfield's plate) is given by De Blainville, *Ostéographie, Viverras*, pl. 12.

² P. Z. S. 1838, p. 59. See also P. Z. S. 1864, p. 520, and Brit. Mus. Cat. p. 54, fig. 8 (skull).

could be the less objected to, since I have found in *Prionodon pardicolor* a tendency to a narrow prolongation upwards of the plantar pad, which I have not found in *Prionodon gracilis*. I hold them therefore distinct quite provisionally and doubtfully. As this species seems never to have been represented, I have thought it well to figure it now.

Fig. 7.

External form of *Poiana*.

The genera yet noticed (*Viverra*, *Viverricula*, *Fossa*, *Genetta*, *Prionodon*, and *Poiana*) form a distinct and very closely allied group, the characters of which may be most conveniently given when the next set of forms has been passed in review.

The genus which it seems to me may best be taken next is the large and polymorphic genus *Paradoxurus*. It contains about a dozen (mostly more or less imperfectly defined) species, which all come from the Asiatic region, from China, Formosa, Nepal and Tenasserim, to Madras, the Andaman Islands, Ceylon, Malacca,

Sumatra, Borneo, Java, and the Philippine Islands. They all agree in having the pollex and hallux well developed, with the metatarsus bald beneath, and also the tarsus, save beneath the heel, where the hair extends across in an evenly curved line. The claws are at least as sharply curved and retractile as in the *Genets* (*cf.* fig. 14 B, p. 192). The tail seems to be, at any rate in some species, slightly prehensile.

The best description I know of the genus is in Temminck's 'Monographie de Mammalogie,' vol. ii. p. 312.

As illustrations of this genus we have:—some plates in Cuvier's 'Mammifères,' vol. ii.; Ogilby, Zool. Journ. iv. tab. 35, suppl.; Horsfield, Zool. Research. in Java (*Viverra musanga*); Buffon, Suppl. iii. pl. 47 (Genette de France); Gray, 'Indian Zoology,' tabulæ 7, 8, 10, and 11; (*P. typus*) Otto, Nov. Act. Nat. Cur. xvii. 2, tabulæ 72 & 73; Temminck, Monographie de Mammal. ii. pls. 64–66 (skulls); Marsden's 'Sumatra,' t. 12 (the Musang); Jacquinot & Pucheran, Voy. au Pôle Sud, Zool. iii. p. 25, pl. 6; P. Z. S. 1856, pls. 47 & 48, and P. Z. S. 1877, pl. 71. Skull: in Brit. Mus. Cat. (1869), pp. 67 (fig. 9), 70 (fig. 10), 71 (fig. 11); Cuvier, 'Planches des Mammifères,' Le Pargouné and Paradoxure de Nubie; De Blainville's 'Ostéographie' (*Viverra*), pl. 2 (skeleton), pl. 6 (skull), pl. 7 (skulls), pl. 9 (parts of axial skeleton and hyoid), pl. 10 (fore limb), pl. 11 (hind limb), pl. 12 (teeth), adult and young.

In this old and well-known genus the skull is less elongated than in *Viverra*. The auditory bulla is, as Prof. Flower has remarked¹, shaped more like that of *Viverra* than that of *Genetta*. It is "conical, broad, and truncated behind, pointed in front, and rather compressed at the sides, which meet in a ridge." The anterior part of the bulla is very small indeed. The opening of the auditory meatus is not large; and its hinder lip is slightly the more prominent. The postorbital processes are generally (not always) rather long and pointed; and the skull is much pinched in laterally behind them. The condyloid foramen is quite covered in and concealed. The paroccipital process is depending; and the mastoid is much as in the Civet. There is an alisphenoid canal. There is a distinct but short carotid canal, the hinder end of which opens near the anterior end of the inner wall of the hinder (and larger) chamber of the bulla. The teeth, as is well known, are less sectorial in character than are those of the genera as yet noticed; but there are considerable differences in different species.

On comparing the teeth of what seems to be an average specimen of *Paradoxurus* with those of *Viverra*, I find $\frac{P.3}{P.1}$ broader in proportion to its length and less vertically extended, with a well-developed cingulum; $\frac{P.4}{P.1}$ with its postero-outer cusp very much smaller and its inner cusp more massive. $\frac{M.1}{M.2}$ is more quadrate, and

¹ L. c. p. 19. He says also:—"The inner or posterior chamber presents, in some species at least, the peculiarity of being permanently distinct and moveable, not only from the other axial bones, but also from the tympanic portion of the bulla."

its inner cusp is much larger relatively; it is really the largest tooth, and has three roots. $\overline{M.2}$ is shaped like $\overline{M.1}$, but is smaller, with two outer cusps and one large inner cusp; it has two roots. $\overline{P.4}$ is broader in proportion to its length and has less talon, but a more marked anterior tubercle. $\overline{M.1}$ is much broader in proportion to its length, and its cusps are less pointed and prolonged. Its talon is raised to the level of the front part of the tooth, and forms the tooth's hinder half with four small cusps arranged in a semicircle, while the front half of the tooth bears three larger cusps, one foremost and the other two side by side. $\overline{M.2}$ is quinquecuspidate, with two large cusps in front (not side by side), and three smaller ones behind arranged in a semicircle.

Comparing the deciduous teeth with those of *Viverra*, I find $\overline{D.2}$ with less talon, $\overline{D.3}$ (the deciduous sectorial) with a relatively smaller internal cusp and with the fourth cusp a little smaller. This tooth is decidedly more sectorial than is the permanent sectorial tooth, its posterior cusp being relatively larger. $\overline{D.4}$ is much like that of *Viverra*, but is rather more quadrate. $\overline{D.2}$ and $\overline{D.3}$ have less talon than in the Civets. $\overline{D.4}$ is more sectorial than the permanent sectorial tooth, and is very like that of the Civet, except that its talon is rather smaller and the tuberosities upon it (especially the innermost one of them) less developed.

As examples of the considerable differences in the forms and sizes of the teeth in different species or races, I may perhaps be permitted to remark that the British-Museum specimen called *P. macrodus* by Dr. Gray well merits its name from the large size of its teeth¹. There is no skin of this species in the collection; and its habitat is unknown. $\overline{M.2}$ are very small in the skulls named *P. larvatus*, *P. grayii*, and *P. lanigera* in the national collection; and they are rather small in *P. zeylanicus* and *P. bondar*. $\overline{P.4}$ (the sectorial teeth) are very sectorial in character in the forms named *P. hermaphroditus*, *P. bondar*, and *P. lanigera*. They are, on the other hand, more quadrangular and very unsectorial in form in *P. macrodus*, *P. nigrifrons*, *P. larvatus*, *P. grayii*, *P. philippensis*, *P. zeylanicus*, *P. leucomystax*, and *P. fasciatus*.

In the Museum of the Royal College of Surgeons there is a skull (No. 4304 B) in which $\overline{M.2}$ are entirely absent. It comes from Nepal.

In the British Museum there is also a skull (No. 154 b), which was purchased from the Zoological Society and said to have come from Manilla, in which $\overline{M.2}$ are also entirely wanting². But the Manilla skull has $\overline{P.4}$ and $\overline{M.1}$ more quadrate and $\overline{P.3}$ much thicker; also $\overline{M.1}$ is wider and $\overline{M.2}$ is larger; and $\overline{P.4}$ is wider and more

¹ P. Z. S. 1864, p. 538.

² On the left side of the skull there are two small holes in the place where $\overline{M.2}$ would be were it present. These holes, however, look more like small fractures or some pathological condition than like alveoli.

cuspidate than in the College of Surgeons' skull. Thus, if a fresh genus were to be made for these two skulls, the two species would differ greatly in the *form* of their teeth, though agreeing as to the *number*. I hesitate, therefore, to separate them, not being able to ascertain if any external distinctions accompany the absence of $\frac{M.2}{M.2}$. Though the skull from Manilla is quite adult and more ridged than that from the College of Surgeons, yet it is much smaller than the latter, its length being only 8".6 instead of 9".6.

The scent-glands lie beneath the surface of a valve-like antero-posteriorly directed cutaneous inflection, more or less naked, and situated between the penis and the testes in the male, and analogously in the female. Temminck says¹, "Le plus grand nombre des paradoxures est muni d'un organe semblable." With the kind assistance of Mr. Bartlett I have verified the existence of this pouch in one of the Paradoxures, named *P. typus*, living in the Gardens; and I have also noted that the skin around the anus is naked. The pupil is linear.

Thus the genus *Paradoxurus* has the characters before enumerated as those of *Viverra*, except Nos. 6 (sometimes), 24, 45 (sometimes), and 47. As to character 26, it is possible in some species the anus may open into a saccular depression; but I have not observed it or any record of its so doing. Chatin is silent as to the genus *Paradoxurus*. I do think it probable that when the species of this genus have been well worked out, it will be found to be subdivisible into two or more genera.

As it is, however, I can find no characters to justify the separation of any Paradoxures into the genus *Paguma* of Gray; but it is otherwise as regards *Arctogale*.

The genus *Arctogale* was instituted by Prof. Peters, but not published by him. It was adopted from him, and published by Dr. Gray². The type species of the genus is described in Temminck's 'Monographies,' vol. ii. p. 333, under the name of *Paradoxurus trivirgatus*; and he figures (pl. 63) the entire skeleton ($\frac{2}{3}$ size of nature), with the skull and dentition (of the natural size). It has been described under the same name by Gray in P. Z. S. 1832, p. 68, and by G. S. Müller in Verhand. i. sp. 3, p. 55. Its external form does not appear to have been figured hitherto, and has therefore been given here. There are nine skins and three skulls of this species in the British Museum, one skull (No. 1656 a) being labelled *Paguma stigmatica*, which is really but a synonym.

Arctogale trivirgata comes from Singapore and Burmah, and also from Java and Sumatra according to Temminck (where he says it inhabits the mountains of from 3000 to 3500 feet elevation), and from Tenasserim according to Blyth.

A. stigmatica is said by Temminck ('Esquisses Zoologiques,' p. 121) to have been found in the south of Borneo. The size attained is considerable, the length of the head and body being sometimes 58".4, and that of the tail 43".2.

¹ L. c. p. 313. ² P. Z. S. 1864, p. 542; and Catalogue of Carnivora, p. 75.

It is by cranial and dental characters that this genus is distinguishable, as was pointed out by Dr. Peters and Dr. Gray. The palate is much more prolonged behind the last molars than in any *Paradoxure*. In *Paradoxurus grayii* (in which it is more prolonged than in any other *Paradoxure*) the first molar's length is only 10, the whole cranial length being taken at 100, while in *A. trivirgata* it is 12.6 or even 14.8, and in the specimen named *A. stigmatica* 13.0. Moreover the hinder portion inclines more or less strongly

Fig. 8.

External form of *Arctogale*.

upwards as it proceeds backwards, and there is a deep notch with a semicircular or more than semicircular outline on each side of the prolonged median portion. The hinder portion of the alveolar border of the mandible is also singularly everted.

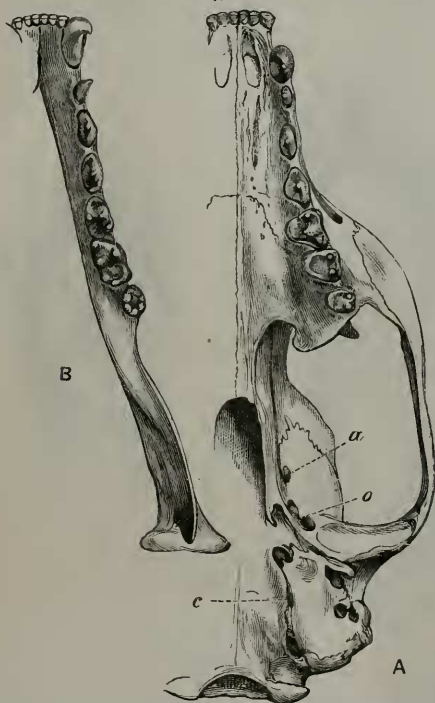
The teeth of *Arctogale* are remarkable for their small size and very unsectorial character. $\underline{P. 4}$ and $\underline{M. 1}$ are very nearly equal in

size; and $\frac{M. 2}{M. 2}$ are fairly developed. In other respects the cranial and dental characters are those of *Paradoxurus*.

Temminck says nothing about the scent- or prescrotal gland, which I presume is as in *Paradoxurus*. S. Müller is also silent about it.

Arctogale, then, differs from *Viverra* as to Nos. 24, 33, 47, 48, 49, and 50.

Fig. 9.



Half basis cranii (A) and half mandible (B) of *Arctogale*.

a, Anterior opening of the alisphenoid canal; o, foramen ovale; c, carotid canal.

The genus *Hemigalea* was instituted by Jourdan (Compt. Rend. 1837, p. 442, Ann. des Sc. Nat. vol. viii. p. 277) for the *Paradoxurus derbianus* of Gray (P. Z. S. 1837, p. 67, and Loudon's Mag. Nat. Hist. i. 1837, p. 579). It is the *Viverra hardwickii* of Gray (Spic. Zool. ii p. 9, t. i.), the *Viverra boiei* of S. Muller (Zoog. Ind. Archip. p. 121, t. xviii., which contains a representation of the external form, skull, and dentition), and the *Hemigale zebre* of the

'Voyage de la Bonite,' p. 28, pl. v., which is a good coloured representation of the animal, with outline of skull and teeth, which are also figured (under the name *Paradoxurus derbyanus*) on pls. vii. and xii. of De Blainville's 'Ostéographie' (*Viverra*). It is an inhabitant of Malacca and Borneo. It differs strikingly from most other *Viverridæ* by its system of coloration, as it has transverse stripes instead of longitudinal markings and spots. It is in this respect only approached by the Linsangs. Its ground-colour is whitish

Fig. 10.

Pads of *Hemigalca*.

A, left manus ; B, left pes.

yellow, with red-brown markings. The tail is ringed at its proximal part, but is black distally. There are three stripes on the head, two down the neck, and it is irregularly marked on the shoulders. The hair on the dorsum of the neck is reversed in direction. The claws are sharp and retractile.

The pads, besides those beneath the five toes, are concentrated, so as to form a considerable naked space (pointed upwards) on the metatarsus, while the tarsus is almost, if not quite, entirely hairy. No hairy interval divides the proximal and distal portions of the palmar pad. The claws are strongly arched (*cf.* fig. 14 D, p. 192.

The pollex and hallux are very well developed.

In its cranial characters *Hemigalea* resembles *Paradoxurus*. Its bulla is of the same form, but ankylosed into one piece. The paroccipital is depending, the mastoid very slightly marked; there is an alisphenoid canal; and the condyloid foramen is concealed; but the hinder opening of the carotid canal is rather more anteriorly situated with respect to the bulla. Its anterior end notches the alisphenoid as always hitherto. The postorbital processes are very small, that of the malar almost obsolete. When the skull is looked at in profile, the dorsum of the muzzle is very concave, and a deepish groove runs antero-posteriorly along the junction of the nasal bones. There is a peculiar depression or notch in the upper alveolar border to receive the apex of $\overline{P.2}$.

The teeth are the teeth of *Paradoxurus*; but the outermost upper incisor of each side is more separated from the incisor next it, and $\frac{M.2}{M.2}$ are very well developed. $\frac{P.3}{P.3}$ has a distinct internal tubercle; and there is even a very small one to $\frac{P.2}{P.2}$. $\overline{P.2}$ is very much extended vertically, and is received into the upper alveolar notch just mentioned.

Length of head and body about 38".1; of tail 40".6.

Nothing is said as to any scent-gland in the 'Zoology of the Voyage of the Bonite'; nor do I find any other notice about it. In a female specimen most kindly presented to me by Mr. A. D. Bartlett, and which I dissected (portions of its anatomy being preserved in the museum of the Royal College of Surgeons), I found superficial folds something as in *Genetta*—two oblique shallow folds extending obliquely upwards and outwards from near the anus to the vicinity of the vagina. The secretion could be squeezed into these folds, just as in the specimen I examined of *Genetta tigrina*. The tongue exhibited an oval patch of much enlarged but soft papillæ on the anterior half of the dorsum of that organ.

A very peculiar plate-like enlargement of the radius is to be found on its outer border a little above its styloid process. Into this are inserted the *supinator longus*, the *pronator radii teres*, and, especially, the large *pronator quadratus*.

Hemigalea agrees with *Viverra* as to the characters so often referred to, except Nos. 2 (perhaps), 24, 42, 43, 51, 52, and 53.

The Binturong (*Arctictis*), the systematic position of which was for a time so much mistaken, is a good example of the small value of dental characters as guides to the essential affinity of an animal.

Were it not for *Arctogale* (which tends to bridge over the dental differences between *Arctitis* and *Paradoxurus*), the Binturong would be an exception amongst the *Viverridæ*, something as *Proteles* is amongst the *Hyænidæ*. *Arctitis* may be confidently affirmed to be an aberrant *Paradoxure*. The animal seems to have been first described by Sir Stamford Raffles (as *Viverra binturong*) in the Trans. Linn. Soc. vol. xiii. p. 253.

The genus *Arctictis* was instituted by Temminck, who gives it in the 'Tableau Méthodique' (1827), p. xxi, in the beginning of his first volume of the 'Monographie,' in the second volume of which, p. 305, is a full description, with a figure of the skeleton half the size of nature, and one of the skull and dentition of the natural size. De Blainville, in his 'Ostéographie' (*Subursus*), gives a figure of the entire skeleton on pl. 4, of the skull and dentition on pl. 7, with some details of the axial skeleton on pl. 8, of the appendicular skeleton on pls. 9 & 10, with the adult and milk-dentition on pl. 11. F. Cuvier has figured the dentition in the 'Dents des Mammifères,' pl. 3 *bis*. F. Cuvier also figured the animal (Mém. du Mus. vol. ix. p. 44, t. 4) under the name *Paradoxurus albifrons*; and another figure of a semi-adult individual (under the name Binturong) in his 'Mammifères,' vol. ii. Valenciennes has also figured it (under the name *Ictides albifrons*) in Ann. des Sc. Nat. vol. iv. p. 57, pl. 1. In the 'Journal of the Asiatic Society of Bengal,' vol. xv. 1846, p. 192, there is a short but interesting account of the animal. It is referred to in S. Müller's 'Zoog. Ind. Archipel,' p. 32. The anatomy of this animal has been described by the late Prof. Garrod in P. Z. S. 1873, p. 196, with a further note (as to the occasional absence of the cæcum¹) in 1878, p. 142.

The animal comes certainly from Borneo; and some say, from Java, Sumatra, and Malacca also.

The ears are tufted, the tail long and, to a certain extent, prehensile; and the tarsus and metatarsus are both entirely naked. As to the cranium, the bulla is formed on the type of that of *Paradoxurus*, except that the two parts are completely ankylosed in the adult. There is an alisphenoid canal, but no pterygoid fossa. The external opening of the auditory meatus is small and oval. The postorbital processes are very short and blunt (the malar hardly indicated); and the cranium is not laterally constricted behind them. The condyloid foramen is concealed. The cranial ridges are not largely developed; but the paroccipital process depends, and the mastoid is rather marked. The carotid canal opens posteriorly at the middle of the inner side of the auditory bulla, while anteriorly it notches the alisphenoid. There is no foramen or fissure in the floor of the auditory bulla's anterior chamber; but there is a very deep pit (to receive the cornu of the hyoid) on the side of the bulla just behind the external auditory opening. The palate is greatly prolonged behind the hindmost molars. The angle of the mandible is very small. The zygomatic arches present a rather concave instead of a convex outline medianly when viewed from above or below. The premolars and molars are small and separated one from another by small but marked intervals. The number of teeth varies slightly, as either M. 2 or P. 1 may be wanting, and (according to Raffles) there may be six teeth in the lower jaw; *i. e.* P. 1 is probably present sometimes,

¹ That there is much variation as to this part is shown by the record, in vol. xv. p. 193 of the 'Journal of the Asiatic Society of Bengal,' that the cæcum is half an inch long.

though I have never seen it. $\overline{M.2}$, if present, is very small, one-rooted, and much less than half the size of $\overline{M.1}$. $\overline{M.1}$ is much like the same tooth in *Paradoxurus*, but is less transversely extended in proportion to its length; it has three tubercles and three roots. $\overline{P.4}$ is like that of *Paradoxurus*, save that it is modified by the very great reduction of the foremost and hindmost outer cusps, which are each connected by a ridge (the cingulum) with the largely-developed inner cusp. $\overline{P.3}$ is a trihedral tooth with rounded angles; $\overline{P.2}$ is similar but smaller; and $\overline{P.1}$ may be wanting, but if present is long and conical. $\overline{P.1}$ is wanting. $\overline{P.2}$, $\overline{P.3}$, and $\overline{P.4}$ are conical teeth, increasing in breadth progressively backwards. $\overline{M.1}$ is much as in *Paradoxurus*, but is broader in proportion to its length. The talon does not form quite half the tooth. $\overline{M.2}$ is more rounded than generally in *Paradoxurus*; it is not much smaller than $\overline{P.4}$. As to the milk-dentition, the deciduous upper sectorial ($\overline{D.3}$) is much more sectorial than is the permanent sectorial tooth. It is very narrow from side to side, having either a mere rudiment of an internal cusp or none. $\overline{D.4}$ is quite like $\overline{M.1}$. $\overline{D.1}$ is rather more sectorial than is $\overline{P.4}$. The infraorbital foramen opens above $\overline{P.4}$. $\overline{P.4}$ does not bite at all against $\overline{M.1}$ but against $\overline{P.3}$ and $\overline{P.4}$.

The pollex and hallux are very well developed. The claws are strongly arched and pointed (cf. fig. 14 C, p. 192), and more or less retractile.

There is a prescrotal gland, which exudes its secretion into a naked cutaneous invagination placed, like a vulva, in front of the anus.

Arctictis agrees, so far as I can ascertain, with *Viverra*, except in the characters numbered 9, 17 (sometimes), 24, 28 (sometimes), 33, 37, 43, 45 (often), 47, and 50.

The next form is one the nature and affinities of which are to me doubtful. It has, however, so much the general appearance and character of the *Paradoxures* (with which it was at first associated) that I feel compelled to place it in proximity to them, in spite of the very exceptional character of the auditory region of its cranium. Indeed the non-ossification of parts of its bulla may be taken as a great exaggeration of that separate, movable condition of its hinder chamber which we have seen to be the case in *Paradoxurus*. Its claws are like those of the last-mentioned genus, as also the naked condition of its tarsus and metatarsus.

The genus *Nandinia* was instituted by Gray (P. Z. S. 1864, p. 529) for the species previously described by him as *Paradoxurus binotatus* (P. Z. S. 1832, p. 68) and *P. hamiltonii* (P. Z. S. 1852, p. 67, and Illus. Indian Zool.). It is the *P. binotatus* of Temminck ('Monographie,' vol. ii. p. 336), who figures the skull (pl. 65. figs. 7, 8, & 9) and refers to it in his 'Esquisses Zool.' p. 119. Its external form is represented in Gray's 'Illustrations of Indian Zoology.'

The skull and teeth are figured by De Blainville, 'Ostéographie,'

Viverra, pls. 6 & 12, under the name *Paradoxurus hamiltonii*. There is a short description of its anatomy, by Prof. Flower, in P. Z. S. 1872, p. 683.

It comes from Fernando Po and Western Africa, and also, it is said, from Zanzibar.

The Viverrine section of the *Viverrinæ* are rather more African than Asiatic; but this is the only African form of the Paradoxurine section of that subfamily. It seems to be a Paradoxure separated from the others by a more carnivorous dentition, and from all other Æluroides by the non-ossification of the hinder and larger portion of the auditory bulla, which remains cartilaginous.

There is but one known species, the head and body of which measure about $43\frac{1}{2}$, and the tail $30\frac{1}{5}$. It is of a greyish-brown colour, black-spotted, and with the tail indistinctly ringed. There are three short black stripes on the nape (one from the forehead and one from each ear); and there is a yellow spot on each shoulder. The belly is dirty white. The tarsus and metatarsus are about as bald as in *Paradoxurus*. The muzzle is shorter than in any other of the *Viverridæ*. Not only is the hinder part of the bulla cartilaginous, but its anterior part is rather more bullate than (at least generally) in *Paradoxurus*. The opening of the auditory meatus is not large. There is no pterygoid fossa. The postorbital processes are long and pointed; and the skull is much contracted just behind them. The sagittal and lambdoidal ridges, especially the latter, are largely developed. The muzzle is relatively shorter than in any other Viverrine yet reviewed. The paroccipital appears to be depending (though this cannot be asserted in the absence of the bulla); and the mastoid is larger than in any genus as yet here noticed. There is an alisphenoid canal close to the foramen ovale; and the condyloid foramen is very much exposed. There is no anterior carotid foramen other than the usual foramen lacerum. The ascending ramus of the mandible is flattened beneath in a way not existing in any genus yet reviewed, and certainly not in *Paradoxurus*; and the angle is pressed up exceptionally towards the condyle. The teeth are formed on the type of those of the Genet, but are modified in a more sectorial direction. $\overline{M.2}$ is very minute, and sometimes aborts altogether¹. $\overline{M.1}$ is smaller than in the Genets. $\overline{P.4}$ has a posterior cusp as large as in the Genets, and the inner cusp even a little smaller. $\overline{M.1}$ has its talon much smaller than in *Genetta*; and $\overline{M.2}$ is a rounded rudimentary tooth, smaller than that of the Genets.

No infraorbital foramen opens above $\overline{P.3}$; and $\overline{M.1}$ bites against $\overline{P.4}$.

There is no cæcum, as was ascertained by Prof. Flower². I can find no record as to the existence of prescrotal³ or anal glands.

¹ As on both sides of a skull in the Royal College of Surgeons' Museum, and on one side of another skull there.

² P. Z. S. 1872, p. 683.

³ Through the kindness of Mr. Forbes I have been able to ascertain the presence, in a female *Nandinia*, of a bald patch, no doubt glandular, in the situation of the prescrotal glandular structure of *Genetta*.

The tongue is much like that of the Civet, and with no patch of greatly enlarged papillæ on its anterior half.

The characters before given of *Viverra* apply also to *Nandinia*, except nos. 3, 7, 14, 24, 28, 35, 37, 38, 40, 42, 43, 45 (sometimes), 46, and 54.

With *Nandinia* closes the second set of forms of the subfamily *Viverrinæ*; and the characters of these two sets may be expressed as follows:—

In the Viverrine section of the *Viverrinæ* we find:—

- (1) Auditory bulla entirely ankylosed into one mass.
- (2) Bulla not always, or greatly, narrowing anteriorly.
- (3) Palate never much prolonged beyond hindmost molars.
- (4) Mastoid never very prominent.
- (5) A cæcum constantly present.
- (6) Teeth always sectorial, never very small; anterior premolars not very long.
- (7) Margins of palate not nearly parallel.
- (8) A supracondyloid foramen to the humerus.
- (9) A median groove beneath the nose on the upper lip.
- (10) Tarsus and metatarsus often entirely hairy, never entirely naked.
- (11) Tail long.

In the Paradoxurine section we meet with the following characters:—

- (1) Auditory bulla often in two pieces; hinder chamber in one species not ossified.
- (2) Bulla, when ossified, always greatly narrowing anteriorly.
- (3) Palate sometimes much prolonged beyond last molars.
- (4) Mastoid in one form very prominent.
- (5) Cæcum sometimes absent.
- (6) Teeth sometimes but little sectorial and occasionally very small; anterior premolars not very long,
- (7) Margins of palate not nearly parallel.
- (8) A supracondyloid foramen to humerus.
- (9) A median groove beneath the nose, on the upper lip.
- (10) Tarsus and metatarsus often entirely naked, never entirely hairy.
- (11) Tail long.

The genus *Cynogale* was founded by Gray¹ on a skin in the collection of our Society, supposed to have formed part of the collection of Sir Stamford Raffles, and therefore to have come from Sumatra. It was described and figured in 1837 by De Blainville, under the name *Viverra carcharias*, who gives some anatomical details (Ann. Sc. Nat. 2^e sér. vii. p. 280, pl. 8); and in 1839 by S. Müller (Zoog. Ind. Archip. p. 115, pl. 17, showing the external form, skull, and dentition), under the name *Potamophilus barbatus*; and in 1841 by MM. Eydoux and Souleyet (in 'Voyage de la

¹ P. Z. S. 1836, p. 88.

Bonite,' p. 24, pl. 6), who have given an excellent figure of the external form, with an outline of the skull and teeth. The entire skeleton is represented by De Blainville on pl. 3 of his 'Ostéographie' (*Viverra*); while its skull is admirably figured in profile on pl. 7, the atlas, axis, sternum, and hyoid on pl. 9, its appendicular skeleton on pls. 10 and 11, and its dentition, both young and adult, on pl. 12.

The animal comes from Borneo. It was erected by Dr. Gray, first into the tribe *Cynogalinae*¹ and then into the family *Cynogalidae*², mainly on the ground of the nose having no median groove beneath it, a character very useful for zoological purposes, but, as it appears to me, trivial as the mark of a family or subfamily. I do find, however, a groove beneath the nose, though none on the upper lip.

Fig. 11.



Pads of left pes of *Cynogale*.

Its webbed feet, short tail, long moustaches³, together with its exceptional upper lip, serve, however, to mark it as a very distinct genus, as does also the absence of the supracondyloid groove of the humerus. The feet are much less bald than in *Arctictis*. The metatarsus, indeed, is hairless; but the tarsus is clothed beneath with short hairs. The claws are rather elongated (*cf.* fig. 14 E).

The pollex and hallux are very well developed.

¹ P. Z. S. 1864, p. 521.

² Cat. of Carnivora, p. 78.

³ When the head of this animal is viewed from above (as in S. Müller's figure) it presents a singular resemblance to the head of *Potamogale*.

The colour of the coat is red-brown, with no markings save a very narrow black line along the crown of the elongated head. The ears are small, the whiskers very long. The hair is crisp, short, and thick. The tail is very short, tapering rapidly. A bunch of whisker grows from below each ear as well as on each side of the nose. The claws are strong, sharp, and retractile. Length of head and body about 68''·5, that of tail about 14''·5.

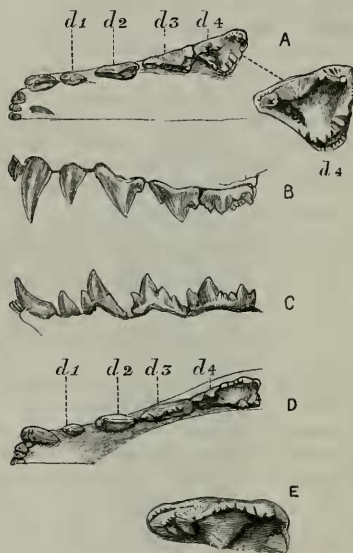
The cranium is of an intermediate type—somewhat Civet-like and Paradoxure-like. The bulla is shaped like that of the Civet, but is less prominent. The anterior part of it is especially flattened. The opening of the external auditory meatus is small. The postorbital processes are very small indeed; but the skull is extremely narrowed and pinched in behind them. The condyloid foramen is quite concealed. The sagittal ridge is pretty well developed, and the lambdoidal ridge is very large. The paroccipital is depending. The mastoid is prominent, though not so markedly so as in *Nandinia*. There is an alisphenoid canal which opens posteriorly opposite and close to the foramen ovale. The carotid canal opens posteriorly near the middle of the inner margin of the larger chamber of the bulla; while anteriorly the carotid artery enters by the foramen lacerum, notching the sphenoid. There is a pterygoid fossa, and a very large infraorbital foramen, which opens above the $\underline{P.4}$. The palate is exceptional in shape, having nearly parallel lateral margins. Dentally, *Cynogale* is a much modified Paradoxure. The differences are mainly as follows:— $\underline{M.2}$ is relatively larger and more nearly equal to $\underline{M.1}$. $\underline{M.1}$ is almost quite as large as $\underline{P.4}$, which has its inner tubercle still larger in proportion to the rest of the tooth than in *Paradoxurus*. It has three external cusps, the first and third being largely and equally developed, and the middle cusp not descending very much below them, a form of tooth unlike that of any other yet here-described Viverrine animal. $\underline{P.3}$ is of very great vertical extent (relatively greater than any yet described here); and the same may be said of $\underline{P.2}$, which is somewhat recurved towards its apex. $\underline{P.3}$ is a longish caniniform tooth, recurved towards its apex and placed close behind the canine. The lower premolars are correspondingly developed. $\underline{P.3}$ has two small posterior basal cusps. $\underline{P.4}$ has a very long talon with two cusps (one before the other), and then also an accessory anterior cusp. $\underline{M.1}$ has a talon which is so large that it forms half the crown of the tooth, and bears three or four tubercles.

As to the milk-dentition, $\underline{D.2}$ is very much like $\underline{P.2}$. $\underline{D.3}$ is intermediate in character between $\underline{P.3}$ and $\underline{P.4}$, but is more like $\underline{P.3}$. Instead of being much like the permanent sectorial (as in *Genetta* and so many other forms), its very small inner tubercle is placed inside quite the hindmost part of the tooth. $\underline{D.4}$ is very peculiar: it is like the permanent sectorial, but with the inner part rather more posterior in position, and with a talon (bearing an inner

and outer tubercle and a posterior cingulum) added on behind it. $\overline{D.1}$ is like $\overline{P.1}$, and $\overline{D.2}$ is like $\overline{P.2}$, with a small basal anterior cusp added. $\overline{D.3}$ is like $\overline{P.4}$, only with rather more talon; but $\overline{D.4}$ is a quite extraordinary tooth: it is like $\overline{D.4}$ of *Genetta*, with the addition of an enormous talon bearing five tubercles, three external and two internal; it is like both $\overline{P.4}$ and $\overline{M.1}$ of the permanent dentition ankylosed together, only the three anterior cusps are not in the same antero-posterior line as they are in $\overline{P.4}$.

I can find no record as to the existence of any prescrotal gland, or

Fig. 12.

Milk-teeth of *Cynogale*.

- A. Grinding-surface of upper series, with the addition of d_4 twice the natural size. B. Side view of upper series. C. Side view of lower series. D. Grinding-surface of lower series. E. Fourth lower molar, twice the natural size.

as to the condition of its anal region. De Blainville says that "la langue est garnie de papilles cornées," that the large intestine is 6 inches long, the cæcum 6 lines, and the small intestine 4 inches.

Cynogale, so far as known, agrees with *Viverra* in the characters before given, except as regards nos. 23, 24, 35, 37, 40, 43, 44, 47, 55, and 56.

The characters of this small third section of the Viverrine sub-family may be thus drawn out:—

- (1) Auditory bulla ossified and in one piece.
- (2) Bulla narrowing and much flattened anteriorly.
- (3) Palate not much prolonged behind last molars.
- (4) Mastoid rather prominent.
- (5) Cæcum very small.
- (6) Teeth suited for catching fish; anterior premolars very long.
- (7) Margins of palate nearly parallel.
- (8) No supracondyloid foramen to humerus.
- (9) No median groove on upper lip.
- (10) Tarsus hairy; metatarsus naked.
- (11) Tail short.

The following characters are common to the *Viverrinæ* :—

- (1) Claws strongly curved, sharply pointed, and more or less deeply retractile.
- (2) Orbits never enclosed by bone.
- (3) Hinder chamber of auditory bulla never everted outwards.
- (4) Posterior margin of the external auditory meatus as prominent as, or more so than, the anterior or inferior margin.
- (5) Floor of external auditory meatus and adjacent part of bulla neither fissured nor with a foramen ora deep pit on its surface.
- (6) Angle of mandible never everted.
- (7) Mastoid rarely prominent.
- (8) Paroccipital processes almost always depending.
- (9) Aperture of external auditory meatus not triangular.
- (10) Alisphenoid canal generally elongated.
- (11) Carotid canal notching the sphenoid, and not showing as a conspicuous foramen in the basis cranii.
- (12) Prescrotal scent-glands generally present.
- (13) Anus opening on the surface, and not into a cutaneous invagination¹.
- (14) Only a pair of anal glands.
- (15) A supracondyloid foramen to humerus, save in *Cynogale*.
- (16) An alisphenoid canal present, save generally in *Viverricula*, where, when absent, its place is not indicated by bony processes.
- (17) Both pollex and hallux present.
- (18) Cæcum sometimes absent.
- (19) Tarsus and metatarsus hairy or bald.

The very large and polymorphic genus *Herpestes* was divided by Dr. Gray (P. Z. S. 1864, and Cat. Carnivora, p. 154) into the genera *Athylax*, *Calogale*, *Galerella*, *Calictis*, *Ariela*, *Ichneumia*, *Ura*, *Tanigale*, *Onychogale*, and *Helogale*. Not one of these, save possibly the last, can be maintained as a distinct genus. Mr. Oldfield Thomas, who has been working with great care at these animals, told me he had come to this conclusion; and my examination of the skins and skulls in the British Museum has only served to confirm the justice of this view.

¹ I give this character with hesitation, from what I have (as before said) observed in a living *Paradoxurus*.

The genus is found in South Europe, all Africa, Asia Minor, Persia, and nearly the whole of the Oriental zoological region, and Foochow.

The genus contains about twenty-one species, of which thirteen are Asiatic and seven African.

The Asiatic species (thirteen in number) have been carefully worked out by Dr. J. Anderson¹; for the rest (the African seven species) I may refer to Mr. Oldfield Thomas's paper, recently read before this Society².

All the species have five digits to each foot; but the pollex and hallux are very small. The claws are longer and less curved than are those of the genera as yet described (*cf.* fig. 14 G, p. 192). The body and tail are always long, and the legs short. The amount of hair to be found beneath the tarsus varies much. Generally both the tarsus and metatarsus are naked beneath; but in some individuals of a species in which these parts are naturally naked, the tarsus may be more or less hairy, the hairy part having an ill-defined limit. Thus the specimen of *Herpestes paludosus*³ (No. 61. 6. 1. 3) has the tarsus hairy beneath, while in another specimen it is quite naked.

The hair of the body is generally clothed with annulated fur, without any special markings on either shoulders, sides, or belly; while a few have neck-markings, and one or two species have uniformly-coloured fur. In all the African forms the hair seems to be more or less annulated; but in three Asiatic species it is not so. The ears are short and rounded. There is no scent-gland between the penis and testes; but the anus often opens into the middle of a sac-like depression, deepest on its hinder side, into which depression more or less numerous anal glands and glandular follicles open.

The skull is elongated, with postorbital processes which are long and pointed, generally enclosing the orbit posteriorly, though sometimes not nearly joining the malar. As Prof. Flower has pointed out⁴, the auditory bulla is somewhat pear-shaped—the larger, rounded end being turned backwards and somewhat outwards, a well-marked transverse constriction separating the hinder (and here outer) chamber from the (also dilated and bullate) anterior (and inner) chamber. As Prof. Flower has also remarked, the aperture of communication in the osseous partition between the two chambers is rather larger than in the Civets, Genets, and Paradoxures.

There is always an alisphenoid canal; but this is very short. The external auditory opening is very small and triangular, one angle being directed downwards. There is a foramen or a notch in the floor of the anterior (and inner) chamber of the bulla a little within the opening of the auditory meatus; and thus we have here an incipient defect of ossification in the floor of that passage; in *Herpestes urva* this defect is more marked, being rather a fissure than a foramen. The

¹ 'Zoology of Western Yunnan,' p. 168.

² On Jan. 3, 1882.

³ Or *H. galera*. This is the Vansire of Buffon, Hist. Nat. vol. xiii. p. 157, pl. 21.

⁴ P. Z. S. 1869, p. 20 and fig. 9.

anterior margin of the external auditory opening is slightly more produced than is the posterior one. The pterygoid fossa is small or absent. The condyloid foramen is concealed. The cranium is much pinched in behind the postorbital processes. The cranial ridges are small or moderate. The paroccipital processes do not depend. The mastoid is considerably developed (as in *Cynogale*), forming a considerable external ridge. The carotid canal begins near the anterior end of the inner wall of the hinder (and outer) chamber of the bulla. It opens anteriorly at the outer or inner end of the anterior (and inner) chamber; and there is a mostly conspicuous foramen in the basis cranii between the alisphenoid close to the basisphenoid, through which the internal carotid artery passes up into the cranial cavity beside the hinder part of the sella turcica. The palate is greatly prolonged behind the last molars. The infraorbital foramen opens generally above $\underline{P.3}$.

In dentition *Herpestes* generally much resembles *Genetta*, especially in the excessive transverse extension of $\underline{M.1}$ and $\underline{M.2}$. Sometimes, as in *H. persicus* (No. 1436 *b* in the British Museum), $\underline{M.2}$ is very minute; and occasionally, as in *H. smithii* (No. 979 *a*, the skin also in the collection), $\underline{M.2}$ is wanting (with no trace of an alveolus) on one side, and very minute on the other. Generally $\underline{M.2}$ has two small outer and one large internal cusps. Generally also $\underline{M.1}$ is more transversely extended and more trihedral than in any yet here described genus, and its posterior margin is rather more concave; otherwise it is shaped as in *Genetta* and *Viverricula*. $\underline{P.4}$ is quite like the homologous tooth of the Genets. $\underline{P.3}$ is somewhat broader behind than in *Genetta*, and has a small posterior inner cusp; and it is therefore more like the $\underline{P.3}$ of *Paradoxurus*. $\underline{P.2}$ is much as in *Viverra*. $\underline{P.1}$ is smaller, and may be absent altogether (as in No. 4324 of College of Surgeons' Museum and No. 148 *c* of British Museum). The teeth of the lower jaw are like those of the Genet, except that the inner cusp of $\underline{M.1}$ is rather more developed. $\underline{P.4}$ is rather broader posteriorly, and $\underline{P.1}$ is sometimes wanting.

The teeth of *H. paludosus* are exceptionally stout, as are also those of *H. robustus*, which are represented in P. Z. S. 1864, p. 558, and Cat. of Carniv. p. 157.

The teeth of *Herpestes* are represented by De Blainville, 'Ostéographie' (*Viverra*), pl. 12, the entire skeleton on pl. 1, and skulls and parts of the appendicular skeleton on intermediate plates. For the basis cranii see P. Z. S. 1869, p. 21, fig. 9.

H. galera is the Vansire of Buffon (Hist. Nat. t. xiii. pl. 21). *H. sanguineus* is figured in Rüppell's 'Fauna of Abyssinia,' pl. 8, and the skull on pl. 10; *H. nuttigella*, pl. 9. fig. 1; *H. gracilis*, pls. 8 & 10; *H. undulatus* and *H. ornatus* (external forms, skulls, and foot-pads) on pls. 25 and 26 of Peters's 'Reise nach Mossambique;' *H. smithii*, P. Z. S. 1851, pl. 31; *H. albicaudus*, Mag. de Zool. 1839, pl. 11; and *H. albescens*, loc. cit. pl. 12; *H. vera*, Calcutta

Journ. Nat. Hist. ii. pl. 13. fig. 2; *H. villicollis*, Madras Journal, 1839, pl. 2. M. Chatin, in vol. xiv. (1874) of the 5th series of the Ann. des Sc. Nat. pp. 79-88, figs. 34-37, describes and figures the anal glands of three species of *Herpestes*. Horsfield describes the anal pouch of another under the name *Mangusta javanica*.

The pupil contracts so as to present a horizontally extended aperture; at least it does so in living examples examined by me and Mr. Bartlett. In *H. auropunctatus* the anus opened most distinctly on the surface of the body, and not into a saccular depression. This fact, and the difference of the teeth in different species, incline me to believe that the genus will hereafter be divided into two or more genera when the structure of all the forms has been thoroughly worked out.

The genus *Herpestes* exhibits the characters before enumerated as existing in *Viverra*, except nos. 18, 20, 21, 22, 24, 26 (often), 29, 30, 31, 32, 33, 35, 36, 37, 38, 40, 42, 43, and 53.

The (to me doubtful) genus *Helogale* was founded by Gray¹, and contains two species, *H. parvula*, from Natal and other parts of South Africa, and *H. undulata* from Mozambique. It is a very small, herpestiform animal, with a bald or nearly bald tarsus. Both its cranial and dental characters are those of *Herpestes*, save that both $\frac{P.1}{P.1}$ are wanting, while at the same time $\frac{P.1}{P.1}$ is placed close behind the canine, so that there is no diastema. The length of the head and body is 25", of the tail 13".

The genus *Cynictis* was instituted by Ogilby in 1833², who has figured the skull and external form in the first volume of our 'Transactions.' There is one species which comes from South Africa. It is of a reddish colour with more or less annulated hair and a bushy tail, with a tarsus which seems to be constantly very hairy; and the metatarsus is also hairy. The animal is herpestiform, but slender, and has no hallux; and the pollex is very short. The orbits are completely encircled by bone; and all the cranial and dental characters are like those of *Herpestes*, save that the infraorbital foramen opens above the interval between $\frac{P.3}{P.3}$ and $\frac{P.4}{P.4}$, and $\frac{M.2}{M.2}$ is rather larger. Its outer internal cusp is more prominent, and sometimes bifurcates at its apex, as it also does in *Herpestes albicaudus* and probably in some others.

The skull (including the *basis cranii*) of *Cynictis* is figured by De Blainville, Ostéog. (*Viverra*), pl. 5; the appendicular skeleton on pls. 10 & 11, and its dentition on pl. 12.

The length of the head and body is 45"-6, of the tail 30"-4. I can find no record of the anatomy of its soft parts or the condition of the anus; but the condition of the skins seemed to me to indicate that the anus opens into a depression as in certain species of *Herpestes*. This suspicion has been confirmed by the examination of a living specimen at our Gardens. *Cynictis* agrees with *Herpestes*, save as above indicated.

¹ P. Z. S. 1861, p. 308; see also P. Z. S. 1864, p. 570, and Cat. of Carnivora, p. 169.

² See P. Z. S. 1833, p. 48, and Trans. Z. S. (1835), vol. i. p. 29, pl. 34.

The genus *Bdeogale* was first proposed by Dr. Peters in November 1850¹, and a full description (with figure of external form, skull, teeth, and feet-pads) given by him in 1862 in his 'Reise nach Mossambique,' Zoology (Mamm.), p. 119, pls. 26 & 27. The genus comes from Zanzibar and Eastern Africa. Peters describes the existence of two kinds of fur (as in *Herpestes*), viz. a thick soft wool, with longer less numerous hairs projecting from amongst it. The snout is rather long and pointed, but has the usual median groove. The pupils are horizontally elliptical; the ears are short and rounded. There is no external trace of either pollex or hallux; the third and fourth digits are of nearly equal length. The tarsus is quite hairy; and so is part of the metatarsus; the tail is bushy.

The skull is said to be quite like that of *Herpestes*, but appears broader, the premolars and molars to be $Pm. \frac{4}{4}$, $M. \frac{2}{2}$, and to resemble in shape those of *Crossarchus* (described *infra*, p. 181). Prof. Peters says:—"Bdeogale presents the following peculiarities:—(1) The outer side of the upper sectorial is scarcely longer than its anterior side, whilst in *Herpestes* and *Crossarchus* it is considerably longer; (2) there is on the postero-internal side of the upper sectorial a low tubercle placed between the greater inner tubercle and the long middle external cusp; (3) the anterior part of the lower sectorial has a fourth small external cusp (instead of being tricuspidate, as in *Herpestes*, *Crossarchus*, and *Suricata*), so that a horizontal section of this division is not triangular but irregularly quadrangular. There are 14 thoracic, 6 lumbar, 3 sacral, and 25 (or 24) caudal vertebræ. The clavicle is absent. The sternum consists of 8 sternebræ, to which 9 pairs of the ribs are attached. There is both an olecranal and a supracondyloid perforation to the humerus. A minute rudiment of a first metacarpal is attached to the trapezium; but there is no rudiment whatever of the first metatarsal. The tongue, like that of *Herpestes*, bears a patch of large backwardly directed spine-like papillæ on the anterior half of its dorsum. The stomach is elongated and bent in the form of a horseshoe. The small intestine is 135" long and 0"·8 thick; the large intestine is 24" long and 0"·15 thick. The anus opens into the middle of a sac or pouch, as in *Crossarchus*². The aorta gives off a common trunk for the carotids and right subclavian, and then the left subclavian separately."

In the stomach of one specimen Prof. Peters found a large *Vipera rhinoceros* (Schlegel).

	millin.
Length of vertebral column from atlas to end of sacrum	290·0
Length of caudal vertebræ	260·0
Length of the skull	78·0
Breadth of zygomata	42·5
Length of humerus	60·0

¹ Mittheilung in der Gesellsch. naturforsch. Freunde zu Berlin, Nov. 19, 1850.

² Dr. Peters says, "Der Analsack ist ganz so wie bei den Mangusten gebildet;" and so I find it.

	millim.
Length of radius	54·5
Length of manus	51·0
Length of third digit	21·0
Length of femora	68·0
Length of tibia	72·0
Length of pes	82·0
Length of fourth digit of pes	23·0

Dr. Peters describes the liver as consisting of three main lobes, the middle one of which has the *ligamentum teres* on its left and the gall-bladder on its right—the left lobe being single, with the right lobe divided by notches into secondary lobes. Dr. Günther had the kindness to place at my disposal for examination the viscera of the specimen in the British Museum. Unfortunately its liver was in a very bad state and much injured; it appeared to me, however, to consist of three main lobes, corresponding respectively (1) to the left lateral, (2) to the left central, and (3) to the right central and right lateral united, and containing the gall-bladder. The caudate lobe seemed to be of much the same size as in *Herpestes*. I could not distinguish the Spigelian lobe.

Dr. Peters does not describe the anal glands; but, from the form of the anal sac, there are probably more than two pairs of them, as in *Crossarchus*.

Length of head and body 40", of tail 30".

There are said to be three species—two from the Mozambique, and one from the Gaboon.

Except as above pointed out, the characters of *Bdeogale* are those of *Herpestes*.

The genus *Rhinogale* was formed by Dr. Gray, in 1864 (P. Z. S. p. 573), for a rather large Herpestiform animal, brought from Eastern Africa by Dr. Meller. The skull is represented by Dr. Gray, and also in his 'Catalogue of Carnivora,' p. 173. The external form has been just represented by Mr. Oldfield Thomas in our 'Proceedings.' The creature differs from all those yet here noticed, except *Cynogale*, in that the nose has no central groove below. There is both a hallux and a pollex; the hair is annulated; and the tarsus is hairy.

The skull in the British Museum (No. 1437 *a*, from skin, 64. 8. 23. 1) has an herpestiform bulla; but the anterior chamber is very much less than the posterior one. The external auditory meatus is small and triangular, with one angle downwards. The postorbital processes of the frontal nearly join the much smaller ones of the malars. The condyloid foramen is exposed. The lambdoidal ridge is rather large, and the sagittal ridge moderate. The paroccipital process does not depend. The mastoid is much as in *Herpestes*; the pterygoid processes are very long, and the pterygoid fossæ very small. There is a distinct, but very short, alisphenoid canal. The carotid canal is as in *Herpestes*. The anterior part of the bulla has a distinct round perforation in its floor, just below and within the

margin of the meatus auditorius externus. The muzzle is short; but the palate is much prolonged behind the last molars.

Its dentition, compared with that of *Herpestes*, presents the following characters:— $\overline{M.2}$ is more quadrate and more nearly equal in size to $\overline{M.1}$. $\overline{M.1}$ is very quadrate. $\overline{P.4}$ is very slightly sectorial, with a large internal tubercle, and resembles the same tooth in the least sectorial *Paradoxurus*. $\overline{P.3}$ is very large, and has a well-developed internal tubercle, with a small cusp behind the large external one, and another small one in front of it, larger, however, than the hindmost outer cusp. $\overline{P.2}$ has a rudimentary internal cusp, and both a minute anterior and a minute posterior external cusp. $\overline{P.1}$ is very small. Besides these four upper premolars and the molars, there is also a small tooth, with a minute basal cusp, placed close behind each upper canine; yet the skull is that of a rather aged individual. I regard this extra tooth as something abnormal.

$\overline{M.2}$ is much larger and more quadrate than in *Herpestes*. $\overline{M.1}$ is also more quadrate than in *Herpestes*, and has apparently been quadricuspidate, but is much worn. $\overline{P.4}$, $\overline{P.3}$, $\overline{P.2}$, and $\overline{P.1}$ are much as in *Herpestes*. Unfortunately I have no means of ascertaining the condition of the anal region. From an examination of the dry skin, the anus appears to me to open into a depression, as in some *Herpestes*. Except as above indicated, the characters of *Rhinogale* are those of *Herpestes*.

Length of the head and body about 53''·1, of the tail 38''·1.

The genus *Crossarchus*¹ was founded by F. Cuvier in 1825 for the Mangue, of which he has given a figure (*Mammifères*, iii.). It is referred to in Temminck's 'Esquisses,' p. 117. Its anatomy was described by Mr. W. Martin (*P. Z. S.* 1834, p. 113). The genus is widely spread over Africa:—one species, *C. obscurus*, from Abyssinia to Gambia and the Cameroons, and another, *C. fasciatus*, from Southern Africa; a third, *C. gambianus*, from Gambia; and a fourth, *C. zebra*, from Abyssinia. All have the hair annulated, the ears small and rounded, the tarsus bald; and they are devoid of a median groove beneath the muzzle. The snout is elongated, hairy beneath, and more or less turned upwards towards the tip. They also have a pollex and hallux; but these are shorter in *C. fasciatus* than in *C. obscurus*. The claws are much elongated.

In *C. fasciatus* there are transverse bands or lines, more or less marked, across the back; these are absent in *C. obscurus*. The pupil is round. The length of the head and body is 36''·8, of the tail 17''·1, in *C. obscurus*; and 45''·8 and 22''·9 in *C. fasciatus*.

The skull of the typical form, *C. obscurus*, has a bulla on the type of *Herpestes*, but with its character exaggerated. There is an alisphenoid canal, but very short, and often imperfectly ossified; but bony processes tending to enclose it may always be detected.

¹ This genus includes the genus *Mungos*, Gray, *P. Z. S.* 1864, p. 575, and *Cat. of Carnivora*, p. 174.

If perfect, it is very short. The opening of the external auditory meatus is small and triangular, and, as it were, somewhat cut away below; and there is a deep groove and a defect of ossification on the floor of the anterior chamber of the auditory bulla. The frontal postorbital processes are well developed; and the skull is much pinched in behind them. There are small pointed malar processes; but these do not nearly join the former. The condyloid foramen is concealed. The cranial ridges are moderate. The paroccipital process does not depend. The mastoid is much as in *Herpestes*, as also is the carotid canal; and there is a conspicuous carotid foramen in the basis cranii; and the artery enters the skull beside the posterior boundary of the sella turcica. The palate is greatly prolonged behind the last molars. In *C. fasciatus* the cranial characters are similar, except that the short alisphenoid canal is better marked, the palate is rather less prolonged, and the postorbital processes more nearly join, and there may be but a very minute foramen instead of a slit beneath the auditory meatus.

The dentition of *C. obscurus* is represented by De Blainville (Ostéog., *Viverra*, pl. 12). Its $\overline{M.2}$ is quite two thirds the size of $\overline{M.1}$, but is triangular, not quadrate. $\overline{M.1}$ is less trihedral than in *Herpestes*, and has two equally developed external cusps, external and parallel to which is a raised straight cingulum. There is a large internal cusp; and the hinder border of the tooth is concave. $\overline{P.4}$ has a rather diminished posterior tubercle (compared with *Herpestes*); so that the large inner cusp is placed rather more towards the middle of the tooth, the length of which is rather less in proportion to its breadth. The inner cusp also descends as much as do the outer ones; and the outer middle cusp scarcely descends below the anterior outer cusp. $\overline{P.3}$ and $\overline{P.2}$ are as in *Herpestes*. $\overline{P.1}$ is wanting. $\overline{M.2}$ is large, with five cusps. In $\overline{M.1}$ the anterior cusp has become more decidedly internal, so that we have an external cusp opposite the internal one. There is a moderate talon. $\overline{P.4}$ has one very large cusp, in front of which may be a well-developed or a minute accessory cusp, while behind it there is a well-developed cusp, which has a more or less marked talon or minute accessory cusp at its base. $\overline{P.3}$ and $\overline{P.2}$ are as in *Herpestes*. $\overline{P.1}$ is absent. In *C. fasciatus*, $\overline{M.2}$ is rather smaller in proportion to $\overline{M.1}$, and $\overline{P.2}$ and $\overline{P.3}$ are larger. In a specimen in the British Museum, labelled *Mungos gambianus* (No. 55. 12. 24. 22 b), $\overline{M.2}$ and $\overline{M.1}$ are very narrow antero-posteriorly. In another skull, labelled *M. zebra* (No. 75. 2. 24. 18), there is a minute $\overline{M.3}$ on each side, which measures 0''·1 antero-posteriorly and 0''·25 transversely.

The dimensions of the skins seen by me are as follows:—of *C. obscurus*, head and body about 37'', of tail 17''; of *C. fasciatus*, head and body about 45''·5, of tail about 23''.

The anus opens into the middle of a very large and deep fossa, into which several pairs of anal glands also open. The structure of these parts is described by M. Chatin as they exist in both species. The condition found in *C. obscurus* is described by him (in a paper entitled "Recherches pour servir à l'histoire anatomique des glandes odorantes chez quelques Mammifères") in a periodical named 'Comp. Rendu Assoc. française,' vol. i. (1872), p. 557. The parts of *C. fasciatus* are described and figured by him (under the name *Herpestes fasciatus*) in the Ann. des Sc. Nat. vol. xix. (5th series), 1874, p. 89, figs. 29-33, and 38.

No less than five pairs of glands are arranged about the anus, and pour their secretion into the capacious and naked anal pouch.

C. fasciatus is described and figured in Buffon, vol. xiii. p. 150, pl. 19.

Except as above indicated, the characters of *Crossarchus* are (so far as I know) those of *Herpestes*.

The Suricate was formed into the genus *Suricata* by Desmarest (N. Dict. d'Hist. Nat. xxiv. p. 16, 1804), and was called *Ryzana* by Illiger (Prodromus, p. 134). It is figured and described by Buffon and Daubenton (H. Nat. vol. xiii. p. 72, pl. 8). Its anatomy has also been described by Hunter ('Essays and Observations,' vol. ii. p. 55) and by Prof. Owen (P. Z. S. 1830, pp. 39, 51).

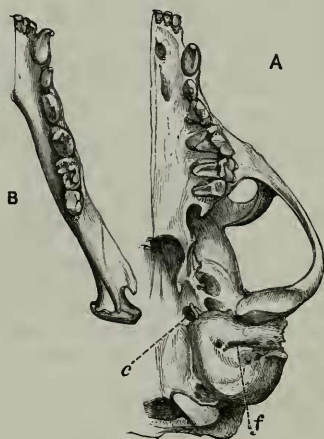
The animal is from South Africa, and is called "Meer Kat" at the Cape. The hair is annulated, and so marked as to form transverse bands across the loins. The ears are very short. The tarsus is hairy. There is no pollex or hallux, there being mere rudiments of the first metacarpal and the first metatarsal beneath the skin. The nose is pointed, rather elongated and movable, and has no median groove on its underside. Length of head and body 38"·8, of tail 21". The skull is relatively very broad, especially behind, facial portion short. The basis cranii shows the Herpestiform character of the bulla carried to a yet more exaggerated degree than in *Crossarchus*; but it is flattened beneath, and the hinder chamber does not generally depend below the anterior chamber. The opening of the external auditory meatus is small and triangular; and its anterior margin projects most.

Prof. Flower has pointed out (P. Z. S. 1869, p. 20) that the much elongated meatus is fissured along the whole extent of its floor. The anterior chamber of the bulla is very prominent; and the opening between the two chambers is rather larger than heretofore. There is a distinct but short alisphenoid canal. There are long postorbital processes which enclose the orbits; but the cranium is very little pinched in behind them. The cranial ridges are moderate. The condyloid foramen may or may not be concealed. The paroccipital process is flattened, and does not depend. The mastoid is very marked, more so relatively than even in *Nandinia*. The carotid canal commences towards the hinder end of the auditory bulla. There is a conspicuous carotid foramen in the basis cranii on either side; and it is almost, if not quite, surrounded by the sphenoid.

The palate is but moderately prolonged behind the last molars. The angle of the mandible is somewhat everted, *i. e.* bent in the opposite way to that in which it is bent in Marsupials.

The skull of the Suricate is figured by De Blainville (*Ostéog., Viverra*) on plate 5, its appendicular skeleton on plates 10 and 11, and its dentition (including the milk-teeth) on plate 12. The teeth are also figured in F. Cuvier's '*Dents des Mammifères*,' plate 35. I find $\overline{M.2}$ and $\overline{M.1}$ to be very much extended transversely, but to be very slightly trihedral in horizontal section. $\overline{P.4}$ is also much extended transversely. $\overline{M.2}$ is shaped very much as in *Crossarchus*,

Fig. 13.



Half basis cranii (A) and half mandible (B) of *Suricata*.

c, carotid foramen; *f*, fissure in floor of auditory meatus.

while $\overline{M.1}$ differs in having its hinder margin hardly, or not at all, concave. $\overline{P.4}$ has its inner tubercle still larger than in *Crossarchus*; and it descends quite as much as does the middle one of the three outer cusps, which very little exceeds in size the other two outer ones. $\overline{P.3}$ and $\overline{P.2}$ are larger and stronger than in *Crossarchus*; and $\overline{P.1}$ is again absent. $\overline{M.2}$ is much as in *Crossarchus*, but smaller. $\overline{M.1}$ is higher and antero-posteriorly shorter; its talon bears two cusps side by side, or three cusps in a semicircle; its anterior part bears two large cusps side by side. The postero-internal cusp of the front part of this tooth of *Crossarchus* has here become rudimentary.

$\overline{P.4}$ has become much raised anteriorly; its talon is large, while the anterior cusp of the same tooth in *Crossarchus* here aborts. $\overline{P.3}$ and $\overline{P.2}$ are very long and strong. $\overline{P.1}$ is absent.

The anus opens into the middle of a very deep fossa, deeper than that of *Bdeogale*, and like that of *Crossarchus*. There is also a curious scrotum-like prominence between the vagina and the anus. I have not met with any description of the anal glands other than that of Daubenton, who says¹:—"Il se trouvoit de chaque côté de l'anús une poche qui avoit quatre lignes et demi de longueur, et trois lignes et demie de largeur, et trois lignes d'épaisseur; le tuyau excrétoire de chacune de ces poches aboutissoit au dedans de l'anús." I strongly suspect, from the form of the anal pouch, that there are here, as in *Crossarchus*, several pairs of anal glands. The claws of the manus of *Suricata* are enormously elongated (cf. fig. 14, H, p. 192). Those of the pes are much less so, but still are long.

Except as above indicated, the characters of this genus agree with those of *Herpestes*; and with it closes the list of the genera of the subfamily *Herpestinæ*.

That subfamily is divisible in various ways, according to the number of digits, the number of teeth, the presence or absence of a subnasal groove, and the number of anal glands, as follows:—

Section A. Anal glands a single pair . . . *Herpestes*, *Helogale*,
Cynictis?, *Rhinogale*?

„ B. Anal glands in several pairs . . *Crossarchus*, *Suricata*,
Bdeogale?

Or, Section A. Toes 5—5 *Herpestes*, *Helogale*,
Rhinogale, *Crossarchus*.

„ B. Toes 5—4 *Cynictis*.

„ C. Toes 4—4 *Bdeogale*, *Suricata*.

Or, Section A. A subnasal groove *Herpestes*, *Helogale*,
Cynictis, *Bdeogale*.

„ B. No subnasal groove *Rhinogale*, *Crossarchus*,
Suricata.

Or, Section A. Pm. $\frac{4}{4}$ *Herpestes* (generally),
Cynictis, *Bdeogale*.

„ B. Pm. $\frac{3}{3}$, $\frac{3}{4}$, no diastema . . . *Helogale*, *Crossarchus*,
Suricata.

„ C. Pm. $\frac{5}{4}$, $\frac{2}{2}$ *Rhinogale*.

The characters of the subfamily *Herpestinæ* will be as follows:—

(1) Claws not strongly curved and not retractile, but pointed and very long.

(2) Orbits sometimes enclosed by bone.

¹ Buffon's Hist. Nat. vol. xiii. p. 80.

² Probably an abnormality.

- (3) Hinder chamber of auditory bulla always everted.
- (4) Anterior margin of opening of external auditory meatus more projecting than the posterior margin.
- (5) Floor of external meatus or adjacent part of bulla with a foramen and fissure in a deep pit.
- (6) Angle of mandible sometimes everted.
- (7) Mastoid always prominent.
- (8) Paroccipital processes depending below bulla.
- (9) Aperture of auditory meatus small and triangular.
- (10) Alisphenoid canal always very short.
- (11) Carotid artery perforating or notching the sphenoid, there being a conspicuous carotid foramen in the basis cranii.
- (12) Never any prescrotal glands¹.
- (13) Anus very generally not opening on the surface of the body, but in a sac or cutaneous invagination.
- (14) Anal glands sometimes in several pairs.
- (15) A supracondyloid foramen to humerus.
- (16) An alisphenoid canal, in rare instances not completely enclosed by bone, but then its place indicated by bony processes.
- (17) Pollex alone, or both pollex and hallux sometimes absent.
- (18) Cæcum always present, but small or moderately long.
- (19) Tarsus and metatarsus hairy or bald.

A very different animal from any hitherto here reviewed is that to which the generic name *Galidictis* was given in 1837 by Isid. Geoff. St.-Hilaire², and again by him in the *Magasin de Zool.* 1839-1841, where the external form and skull, including the basis cranii, are well represented, and a full description given in a long note beginning on page 32. It is also the *Mustela striata* of Geoffroy St.-Hilaire (*Cat. des Mamm.* p. 98), and the *Putorius striatus* of Cuvier (*Règne &c.* 2nd edit. p. 144). The external form has been figured in our *P. Z. S.*, 1848, pl. 1, with a short description and notes as to habits on page 21. The skull is also given by De Blainville (*Ostéog., Viverras*) on pl. 5, and the dentition on pl. 12, under the name *Mangusta (Galictis) striata*. There are two species, both from Madagascar—one the original *G. striata* of Isid. G. St.-Hilaire, and the other *G. vittata*, described and figured by Gray (*P. Z. S.* 1848, p. 21, pl. 1) the skin and the (immature) skull of which are in the national collection, where are also four skins and two skulls of the former species. The length of the head and body of the latter is about 35"·5, of the tail 33". In each species the body bears longitudinal dark stripes on a lighter ground. The claws are long, but considerably curved (*cf.* fig. 14, 1, p. 192). The claw of the pollex reaches to the end of the proximal phalanx of the index, and that of the fifth digit to the end of the proximal phalanx of the fourth digit, which is slightly longer than the index, the median being the longest. The claw of the hallux reaches nearly to the end of the proximal phalanx of the index, and that of the fifth digit of the pes nearly to the

¹ The nature of the prominence in *Suricata* has to be seen.

² *Comptes Rendus*, 2nd semestre de 1837, p. 578.

end of the second phalanx of the fourth digit, which is longer than the index and nearly equals the medius in length. The snout is very pointed in *G. vittata*, but does not appear to be so much so in *G. striata*. In both, the tail has long hairs and the muzzle is medianly grooved beneath; the tarsus is more or less completely bald. The claws are slightly more curved than in the *Herpestinae*.

As to the skull, the auditory bulla is formed on the *Herpestine* type, and has a partition between its chambers, with a considerable aperture for intercommunication. There is a well-developed pterygoid fossa. The external opening of the auditory meatus is small and slightly oval, its anterior margin being produced outwards, but hardly more than is its posterior margin. The postorbital processes are only moderately developed, and do not even nearly meet; the skull is not much pinched in behind them. The paroccipital does not depend; and the mastoid is much as in *Herpestes*, as also is the carotid canal. There is no alisphenoid canal; and the foramen ovale is very near that for the entrance within the cranium of the internal carotid, which is pretty conspicuous. There is no fissure or foramen in the floor of the auditory meatus; but there is a marked depression where such a foramen is found in *Herpestes*. The palate is but little prolonged behind the molars; but this region is concave, each side of it sloping into a median depression, the cranium being turned with its base upwards. The palatine foramina are in the anterior part of the palate, which is remarkably broad. The symphysis of the mandible is extremely long, viz. $1''\cdot7$, the length of the skull being $6''\cdot2$. The zygomata are arched strongly outwards.

In the dentition the most noteworthy point is the large size of the canines, and especially the length, strong curvature, and stoutness of the lower ones, each having a marked prominence at the posterior part of the base of its crown. The upper outer incisors also preponderate greatly over the inner ones. The molars and premolars are formed on the *Herpestine* type; but $\frac{P.1}{P.1}$ are absent, and $\frac{P.2}{P.1}$ is close to the canine and small, though with two roots. $\frac{P.4}{P.1}$ is very sectorial; and the talon of $\frac{M.1}{M.1}$ is small. The inner condyle of the humerus is imperforate.

I can find no record of the condition of the anus, or of the number of anal glands, neither any note as to prescrotal glands. I, however, anticipate that the latter are wanting, that there is but a single pair of anal glands, and that the anus opens on the surface of the body, and not into a pouch.

Galidictis agrees, so far as I know, with *Viverra* in the characters before enumerated, save as regards nos. 7, 16, 17, 18, 20, 21, 23, 24, 29, 31, 32, 35, 36, 37, 38, 42, 43, and 53.

Another genus instituted by Isidore Geoffroy St.-Hilaire for three Viverrine animals from Madagascar, is the genus *Galidia* (Compt. Rendus, 1857, p. 580, and Mag. de Zool. 1839, pls. 14-17). The type of the genus must be taken to be that first described, namely *G. elegans*. The skull and dentition of this species are given by De Blainville (*Viverras*), plate 6.

G. elegans is represented in the British Museum by skins and skulls; and there is a skeleton in the Royal College of Surgeons.

The fur is of one colour, save that the tail is ringed with black, the hair not annulated. The length of the head and body is about 45''·2, and that of the tail is 30''·5. The muzzle seems rather obtuse. The claws are long, but considerably curved. The tarsus and metatarsus are covered beneath with sparse short hairs, or are more or less inclined to be bald, but are not so as in *Galidictis*.

The skull is very like that of *Galidictis*; but the muzzle and palate are narrower relatively, and the mandibular symphysis is much shorter. There is, again, no alisphenoid canal. The condyloid foramen is exposed. The palate is flat, and not concave posteriorly as in *Galidictis*. The zygomata are not quite so much arched outwards. The auditory opening is a more elongated oval. In other respects the skull is as in *Galidictis*.

As to the dentition, it is quite like that of *Galidictis*, save that the canines are smaller, especially the lower ones, the external incisors less preponderating. $\frac{P.2}{P.2}$ is smaller relatively. $\frac{M.2}{M.2}$ may be quite small and placed *within* the hinder part of $\frac{M.1}{M.1}$ ¹.

The preparation No. 2147 B in the museum of the Royal College of Surgeons shows that there is a single pair of rather large anal glands; and the anus does not seem to open into any cutaneous depression.

The two other species described by Isid. G. St.-Hilaire differ considerably from *G. elegans*, as that author himself pointed out, and as has been more decidedly indicated by Dr. F. A. Jentink². I have not had any opportunity of examining *G. concolor*; but, on account of its declared resemblance to *G. olivacea*³ (which is represented by skins, skulls, and a skeleton in the British Museum), it must be separated generically from *G. elegans* if *G. olivacea* is to be so separated. Now two courses seem to me feasible: one is to institute a new genus for the species *olivacea* and *concolor*; and the other is to unite *Galidia* and *Galidictis* in a single genus. But the differences between the last-named genus and *G. elegans* seem to me to be as great as those which separate *Cynalurus* from *Felis*; and as *G. olivacea* (and, as I infer, *concolor*) seems to me to differ as much from *G. elegans* as does this last from *Galidictis*, the more reasonable course seems to me to be to separate them, which I now accordingly propose to do under the generic name *Hemigalidia*.

In external characters *Hemigalidia* differs from *Galidia* in the non-annulation of the tail, in the more pointed muzzle, and especially in the less arched (more Herpestine and less Viverrine) form of its claws (*cf.* fig. 14, J and K, p. 192).

In the skull the bulla is rather more decidedly Herpestiform than in *Galidia*. The carotid foramen (for the entrance of the carotid artery) is more conspicuous; the hind part of the palate is not so

¹ As in the specimens in the Roy. Coll. of Surg. museum.

² See 'Notes from the Leyden Museum,' vol. i. p. 131.

³ On some notes as to the habits of these forms, see Pollen's 'Faune de Madagascar' (1868), p. 23.

uniformly horizontal; the anterior lip of the external auditory opening is more prominent; and the zygomata are much less arched outwards. $\frac{M.2}{M.2}$ are both relatively much larger. $\frac{M.2}{M.2}$ is also large relatively, while a $\frac{P.1}{P.1}$ is developed; $\frac{P.4}{P.4}$ has a larger internal tubercle; $\frac{M.2}{M.2}$ is also relatively larger. Dr. Jentink tells us that the teeth of *concolor* are quite like those of *olivacea*.

It appears that it is a species of this genus which is the Vansire of Buffon (Hist. Nat. xiii. p. 167, pl. 21), as had it been *Galidia* the black-ringed tail would surely have been indicated.

These three genera seem to me to form a section apart, somewhat intermediate between the Viverrine and the Herpestine sections, though (as before said) I regard them as more nearly allied to the latter than to the former.

To the characters to be derived from digits, claws, skulls, teeth, colour, and habitat may be added that of the absence of an internal condyloid canal to the humerus. I propose then (as I before said) to separate this section as a subfamily under the name *Galidictinæ*.

The characters of the *Galidictinæ* will be as follows:—

- (1) Claws not strongly curved and retractile, but yet sometimes more Viverrine than Herpestine.
- (2) Orbits never enclosed by bone.
- (3) Hinder chamber of auditory bulla rather crested.
- (4) Anterior and posterior margins of auditory opening about equally prominent, in the anterior one slightly more so.
- (5) Floor of anterior part of bulla not perforated or fissured, but deeply pitted.
- (6) Angle of mandible not everted.
- (7) Mastoid prominent.
- (8) Paroccipital processes not depending.
- (9) Aperture of auditory meatus small and oval.
- (10) No alisphenoid canal.
- (11) Carotid artery passing through a conspicuous foramen in the basis cranii.
- (12) No prescrotal glands.
- (13) Anus opening on the surface of the body, and not into a cutaneous invagination (?)
- (14) One pair of anal glands.
- (15) No supracondyloid foramen to humerus.
- (16) No bony processes indicate the place of an alisphenoid canal.
- (17) Pollex and hallux both present.
- (18) Cæcum present, moderately long.
- (19) Tarsus and metatarsus hairy or bald.

A more anomalous form of the Viverrine family is that which has been taken to constitute the genus *Eupleres* by its describer Doyère¹, who figured the animal and its (immature) skull. The immature skull has been also fully figured by De Blainville², with the skeleton of the hind leg and foot and the milk-dentition. The

¹ Ann. Sc. Nat. 1835, iv. p. 281, pl. 18.

² Ostéog., Viverras, pls. 8, 11, and 12.

external form and part of the skull of an adult have been figured by Dr. Gray from a specimen now in the national collection¹; and the whole adult skeleton, skull (though not the basis cranii), and dentition have been described and figured by Paul Gervais².

It has been abundantly shown that this animal is not, as was at first supposed, an Insectivore, but really a Viverrine Carnivore.

Externally *Eupleres* is remarkable for its small head, very long, slender, and pointed snout; but its dentition is the most anomalous part of its organization so far as yet known.

The body is clothed with woolly annulated fur of a uniform general olive tint above, minutely punctulated with yellow. It appears, from Doyère, that the young has black bands across the shoulders, which are wanting in the adult. The ears are large; the pollex and hallux are well developed; the tail is rather short, but bushy; the feet are very slender; the tarsus and metatarsus are covered with short hair beneath. The length of the head and body is about 52", that of the tail 17"-7. The nose and upper lip have a median groove beneath. The claws are elongated and Herpestiform (*cf.* fig. 14, L, p. 192).

There are two skins, several skulls, and one good skeleton in the British Museum; and there is a good skeleton in that of the College of Surgeons.

The skull is remarkable for its extraordinary length and slenderness. The shape of the auditory bulla is intermediate between that of the Herpestine and that of the Viverrine sections of the *Viverridæ*: its most prominent portion is at its postero-external part; and so far it inclines towards *Herpestes*. There is no pterygoid fossa. The opening of the external auditory meatus is generally rather small and more or less oval; it is the hinder portion of its margin which projects slightly the more. There is no fissure or foramen in the floor of the auditory meatus; nor is there a depression in the adjacent part of the bulla as in *Galidia* and *Hemigalidia*. The anterior part of the bulla, however, is well marked off by a groove from the posterior part. There is no alisphenoid canal, nor any postorbital processes. Cranial ridges are very faintly marked, save the lambdoidal ridge. The paroccipital is long, but does not depend. The mastoid is not more prominent than in *Genetta*. The condyloid foramen is exposed. The carotid canal is as in *Herpestes*; and the artery enters the cranial cavity through a foramen or deep notch in the sphenoid. The zygomata are very slender; and there is a very small glenoid cavity and postglenoid process. The palate is very little prolonged behind the last molars. There is a very conspicuous and exceptional prominence in the middle occipital region to shelter the middle part of the cerebellum.

The dentition is especially remarkable for the small size of the canines, the canine-like character of the anterior premolars, the resemblance of the true molars to the premolars, and the wide diastemata between the three most anterior premolars both above and below.

¹ P. Z. S. 1870, p. 824, pl. 51.

² Journal de Zoologie, vol. iii. (1874), p. 237.

The outermost upper incisor is caniniform, and nearly as large as is the adjacent canine. $\overline{P.1}$ is a little separate from and a little larger than the canine, which it closely resembles. $\overline{P.2}$ is also caniniform, with a talon: it is separated by a long diastema from $\overline{P.1}$; and another about as long separates it from $\overline{P.3}$. $\overline{P.3}$ is a narrow, antero-posteriorly elongated tooth, with a conical backwardly-directed middle cusp, and with a small anterior cusp and a larger posterior one, at the base of the middle cusp. $\overline{P.3}$, $\overline{P.1}$, $\overline{M.1}$, and $\overline{M.2}$ all join without diastemata. $\overline{P.4}$ has one large median cusp, with one small anterior and one rather large posterior cusp, and with a small internal cusp placed opposite the junction of the anterior and middle cusps. $\overline{M.1}$ has two equal-sized outer cusps, and an inner cusp (larger than that of $\overline{P.4}$) opposite their junction. The anterior outer cusp answers to the anterior outer one of $\overline{P.4}$. $\overline{M.1}$ shows also a minute rudiment of a cusp answering to the postero-outer one of $\overline{P.4}$. $\overline{M.2}$ is very similar to $\overline{M.1}$; but its inner cusp is smaller, and placed opposite to the more anterior of the two outer cusps.

The outermost lower incisor has the postero-outer angle of its crown slightly produced. The canine is like it, save that this angle is more produced. The teeth $\overline{P.1}$, $\overline{P.2}$, $\overline{P.3}$, and $\overline{P.4}$ are all separated by diastemata (of which that between $\overline{P.2}$ and $\overline{P.3}$ is the longest), while $\overline{P.4}$, $\overline{M.1}$, and $\overline{M.2}$ adjoin the one to the other. $\overline{P.1}$ is caniniform. $\overline{P.2}$ is also caniniform, with the addition of a minute anterior cusp and a slight talon. $\overline{P.3}$ has a talon which develops two small cusps, while the anterior cusp is more developed than in $\overline{P.2}$. $\overline{P.4}$ is like $\overline{P.3}$, with all its cusps more developed save the principal cusp. $\overline{M.1}$ has three external cusps (whereof the posterior cusp is the smallest), with an internal cusp placed opposite to the hinder part of the middle outer cusp. $\overline{M.2}$ is similar to $\overline{M.1}$, save that the postero-external cusp is relatively larger and subdivided, and that the internal cusp is connected with it and with the antero-external cusp by ridges. Here $\overline{M.2}$ not only equals, but (at least sometimes) even exceeds $\overline{M.1}$ in size.

In the milk-dentition (judging from De Blainville's figure) $\overline{D.3}$ and $\overline{D.4}$ may resemble $\overline{M.1}$ and $\overline{M.2}$; but $\overline{D.3}$ and $\overline{D.4}$ are unlike any of the permanent teeth, since they seem each to consist of two nearly equally developed external cusps, and they are much more sectorial in character than are the teeth which succeed them, whether from below or from behind. In a word, the milk-dentition is more carnivorous and less insectivorous than are the permanent teeth.

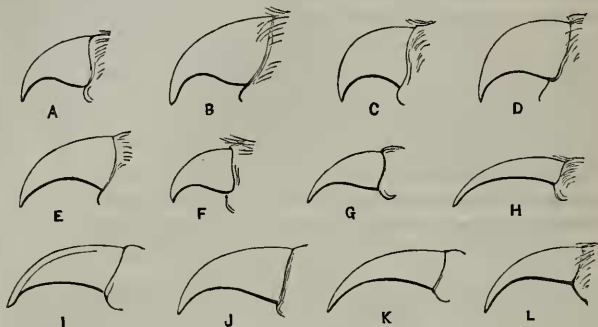
Both the internal condyle and olecranal fossa of the humerus are perforated. There are no signs of scent-glands.

I can find no record of the anatomy of its soft parts.

It appears to me that, of all other *Viverridæ*, *Eupleres* comes nearest

to the genus *Hemigalidia*; but the presence of the intercondyloid canal of the humerus and the very exceptional dentition—exceptional not only amongst the *Viverridæ*, but amongst all *Carnivora*—inclines me to consider it the type of a subfamily, the *Euplerinæ*.

Fig. 14.

Claws of *Viverridæ*, drawn to the same scale.

A. *Genetta senegalensis*. B. *Paradoxurus*. C. *Arctictis*. D. *Hemigalea*.
E. *Cynogale*. F. *Cryptoprocta*. G. *Herpestes*. H. *Suricata*. I. *Galidictis striata*. J. *Galidia elegans*. K. *Hemigalidia olivacea*. L. *Eupleres*.

The characters of that subfamily will be :—

- (1) Claws herpestiform.
- (2) No postorbital processes.
- (3) Hinder chamber of bulla not distinctly everted.
- (4) Hinder margin of auditory opening the more projecting.
- (5) Floor of anterior part of auditory bulla not fissured, or perforated, or deeply pitted.
- (6) Angle of mandible not everted.
- (7) Mastoid not prominent.
- (8) Paroccipital processes not depending.
- (9) Aperture of auditory meatus small and more or less oval.
- (10) No alisphenoid canal.
- (11) Carotid artery passing through a conspicuous foramen in the basis cranii.
- (12) No prescrotal glands (?)
- (13) Anus opening on surface of body (?)
- (14) One pair of anal glands (?)
- (15) A supracondyloid foramen to humerus.
- (16) No bony processes indicate the place of an alisphenoid canal.
- (17) Pollex and hallux both present.
- (18) Cæcum (?)
- (19) Tarsus and metatarsus clothed with short hair.
- (20) Nose and upper lip medianly grooved.

- (21) Snout very slender.
 (22) Zygomata very slender.
 (23) Median cerebellar prominence in skull very marked.
 (24) Canines very small.

(25) Wide diastemata between $\frac{P.1}{P.1'}$, $\frac{P.2}{P.2'}$, $\frac{P.3}{P.3'}$.

(26) $\frac{M.1 \& 2}{M.1 \& 2}$ very like $\frac{P.3 \& 4}{P.3 \& 4}$ in shape.

By characters 21-26 the *Euplerinæ* differ from all the other *Viverridæ*.

In reviewing the *Viverridæ* so far, we have found what seem to be curious modifications of one and another section of the family. Thus, in *Cynogale* we seem to have a Paradoxure specially adapted for an aquatic and fish-catching life—a sort of Viverrine Otter with a singular superficial resemblance to *Potamogale*. In *Arctictis*, on the other hand, we have a Paradoxure specially arboreal, and with teeth so little carnivorous that, but for *Arctogale*, we might hesitate to assign it a close connexion with *Paradoxurus*. Both are Asiatic forms; and Asia is the special home of the Viverrine subfamily of *Viverridæ*. The special home of the Herpestine subfamily is Africa.

Of the Viverrine animals of Madagascar yet noticed, we have the Fossa and Rasse as examples of the *Viverrinæ*; and we have the singular little intermediate group of *Galidictinæ* and the very exceptional *Euplerinæ*. While the most carnivorous Viverrine yet here considered (*Nandinia*) is African, the most insectivorous is from Madagascar, where we might expect to find the most anomalous Mammalian forms. But if I am right in a suspicion I have already expressed, Madagascar is yet more remarkable as presenting the most exceptional development of the Herpestine root of the *Viverridæ*; for it seems to me by no means impossible that *Cryptoprocta* may be a very diverging root-form more or less allied to *Crossarchus* and *Herpestes*.

My examination of the skeleton of *Cryptoprocta* has left no doubt upon my mind that, so far as it is concerned, it is an altogether Viverrine, and not at all a Feline, animal. I cannot, therefore, see my way at present to regarding it as the type of a distinct family, although when its soft parts have been described it may turn out to merit that distinction. Whatever its ancestral affinities may have been, it has clearly attained the rank of a subfamily; and at first I was inclined to regard it (as had been suggested by P. Gervais¹) as a form allied to, and a sort of exaggeration of, the African genus *Nandinia*; but the only portion of its visceral anatomy yet known to me seems to point to another affinity, namely to that I have just indicated. It will, I suspect, be found to have Cowper's glands, a Viverrine prostate gland, and a Viverrine brain, but no scent-gland—no pouch or glandular grooves just behind the genital aperture. The situation of its anal opening in the midst of a fossa, as described by Mr. Bennett², is unlike the *Viverrinæ* and *Galidic-*

¹ Hist. Nat. des Mammif. vol. ii. p. 41.

² Trans. Zool. Soc. vol. i. p. 137.

tinæ; but is a character which is commonly present in the *Herpestinæ*. The remarkable os penis of *Cryptoprocta* is certainly a very distinctive character; but the generative apparatus of *Hyæna crocuta* is far more so, and no one would on that account raise that animal to the rank of even a subfamily. Moreover it is interesting to note that while the os penis is so small and so often absent in the *Viverrinæ*, "il n'en est pas de même dans les Mangoustes; il y est même assez développé"¹—an assertion confirmed by the figures on De Blainville's plate 9: it is equally developed in *Herpestes paludinosus*. The claws are strongly arched (cf. fig. 14 F, p. 192).

As regards the teeth of *Cryptoprocta*, they are, as every one knows, extremely feline; but the longer I live, the more convinced am I that dental characters are valueless as indices of affinity, save as existing in closely allied forms—the different species of one genus. Amongst the *Viverridæ* we have seen how little the dental peculiarities of *Arctogale*, *Arctictis*, and *Cynogale* tell against the weight of other characters; the exceptional teeth of *Gulo*, amongst the *Mustelidæ*, teach the same lesson; and, as I shall shortly endeavour to point out, what I believe to be the affinities of *Proteles* to *Hyæna* and of *Hyæna* to *Herpestes* very strongly reinforce it.

Cryptoprocta, when first described (Trans. Zool. Soc. i. p. 137, plate 21), was ranked by Mr. Bennett, its describer, amongst the *Viverridæ*. De Blainville, in recognizing this affinity as especially justified by the milk-dentition, regarded it as especially allied to *Crossarchus*. He has figured the young skull and the milk-dentition².

The osteology of *Cryptoprocta* has been carefully described and figured by Alphonse Milne-Edwards and Alfred Grandidier in the Ann. des Sc. Nat. 1867, p. 314, pls. 7–10. The animal has also been described, and various details as to its habits given, by Messrs. Pollen and Van Dam in their 'Faune de Madagascar' (1868), p. 13.

Skeletons and two skins exist in the British Museum; and there is a skeleton in that of the Royal College of Surgeons. The length of the head and body of the largest specimen in the British Museum is about 81"·3, that of the tail 73"·7. The body is of one colour. The claws are sharp, very curved, and semicontractile; the tarsus and metatarsus is naked.

The skull has an auditory bulla, which is neither distinctly Herpestine nor Viverrine; it is more prominent than in *Paradoxurus*. The alisphenoid canal is constant³. The pterygoid fossa is very small. The external opening of the auditory meatus is rounded and of moderate size. The postorbital processes of the frontal are rather small, and very distant from the exceedingly small malar processes. The skull is but little pinched in behind the orbits. The condyloid foramen is more or less concealed. The cranial ridges are rather strongly developed. The paroccipital process is long, but not depending. The mastoid is well marked, and more developed than in

¹ De Blainville, 'Ostéographie,' *Viverra*, p. 39.

² Ostéog. Viverras, pls. 6 & 12.

³ Present in all the specimens I have examined.

the Civets. The carotid canal is as in *Herpestes*; and the artery enters the cranium by a well-marked foramen in the basis cranii. There is no foramen, fissure, or fossa on the floor of the auditory meatus. The palate is considerably prolonged behind the last molars. The angle of the mandible is rather short.

Fig. 15.



Soles of the paws of *Cryptoprocta* (after Alphonse Milne-Edwards).
a. Manus; b. Pes.

The teeth of *Cryptoprocta* are most feline. $\overline{P.4}$ more resembles the corresponding tooth of *Felis* than of *Viverra*; but $\overline{M.1}$ is elongated transversely as in *Hyæna striata*, and more so relatively than in the Cats. $\overline{P.3}$ is cat-like, save that the talon is perhaps rather larger. $\overline{P.4}$ is also very feline. $\overline{P.2}$ is much larger than in the Cat, and two-rooted. There may be a small $\overline{P.1}$. In the lower jaw $\overline{M.1}$ is like the last, save that it has a talon. $\overline{P.4}$ is like the Cat's; but its talon is a little larger. $\overline{P.3}$ is larger relatively than in the Cat. $\overline{P.2}$ has two roots.

In the milk-dentition, $\overline{D.4}$ is very much larger relatively than is $\overline{M.1}$. $\overline{D.3}$ (as in the Cat) has its posterior cusp less developed than in the permanent upper sectorial, and its internal cusp more posterior. The lower deciduous sectorial $\overline{D.4}$ has a smaller anterior cusp, and a more exterior talon than has the permanent sectorial. This is as in the Cat; though the difference as to the development of the talon between the deciduous and the permanent sectorial is less in *Cryptoprocta*.

The stomach¹ is much bent on itself, but has a considerable cardiac pouch. The small intestines are 4 feet 3 inches long; the large intestine is $5\frac{1}{2}$ inches, and the cæcum $1\frac{1}{8}$ inch. The latter narrows gradually to its extremity.

There is a very large supracondyloid foramen, and a very large bone to the penis.

The characters of the subfamily *Cryptoproctinae* will then be as follows:—

- (1) Claws very curved, sharp, and semiretractile.
- (2) Postorbital processes long, but not enclosing orbits.
- (3) Hinder chamber of bulla not distinctly everted.
- (4) Hinder margin of auditory opening rather the more projecting.
- (5) Floor of anterior part of bulla not fissured or pitted.
- (6) Angle of mandible not everted.
- (7) Mastoid rather prominent.
- (8) Paroccipital processes not depending.
- (9) Aperture of auditory meatus rounded, of moderate size.
- (10) An alisphenoid canal.
- (11) Carotid artery not perforating the basis cranii conspicuously.
- (12) No prescrotal glands?
- (13) Anus opening into a sac.
- (14) One pair of anal glands?
- (15) A very large supracondyloid foramen to humerus.
- (16) Pollex and hallux both present.
- (17) Cæcum moderate.
- (18) Tarsus and metatarsus bald.
- (19) Nose and upper lip medianly grooved.
- (20) Dentition very feline, save that there is a double-rooted P. 2.
- (21) Tail long.
- (22) Os penis very large.

With *Cryptoprocta* ends the list of genera which I am disposed to class in the family *Viverridae*, following, as I do, Mr. Turner and Professor Flower in ranking the *Hyænas* as a group of proximately coordinate value with the *Feline* and *Viverrine* families.

Nevertheless I believe that the *Hyænidæ* are closely allied to the *Herpestinae*—so much so that, had the Madagascar *Viverrines* no existence, I should feel a certain temptation to exclude the *Ichneumon*s and their allies from the *Viverridae*, and make of them a family *Herpestidae*, under which the *Hyænas* could then be grouped. As it is, however, the plan I have adopted seems to me to be perhaps best calculated to express the affinities of the existing *Æluroidæ*.

The characters of the entire family *Viverridae*, thus understood, may be expressed as follows:—

- (1) There may or may not be a pollex; but in the large majority of species there is one.
- (2) There may or may not be a hallux; but in the large majority of species there is one.
- (3) The ungual phalanges may or may not be strongly arched; but

¹ Bennett, *l. c.* p. 139.

there is not so wide a lamina of bone to shelter the base of the claw as in the *Felidæ*.

- (4) The claws may be considerably arched, or they may be long and very slightly so. They are hardly ever (not except perhaps in *Prionodon* and *Poiana*) completely retractile, and often are not at all so.
- (5) The auditory bulla (except in *Nandinia*) is ossified, much inflated, and shows externally that it consists of two chambers.
- (6) The bulla is not more prominent towards its inner than towards its hinder border.
- (7) There is an almost complete bony septum between the two chambers of the bulla, which may or may not be one behind the other.
- (8) The bony meatus auditorius is almost always short, and may have its anterior, posterior, or inferior margin most projecting; and it may be imperfectly ossified below.
- (9) There is a carotid foramen, or two carotid foramina, visible on each side of the basis cranii.
- (10) There is (except often in *Viverricula*) an alisphenoid canal.
- (11) The palatine foramina are situated in the anterior half of the palate.
- (12) $\overline{P.1}$ is generally and $\overline{P.2}$ constantly developed.
- (13) There is always an $\overline{M.2}$, and generally an $\overline{M.2}$.
- (14) $\overline{M.1}$ is always present, generally large.
- (15) The antero-external cusp of $\overline{P.4}$ is generally very small.
- (16) $\overline{M.1}$ has almost always a considerable talon.
- (17) The outer incisors may greatly exceed the middle ones in size.
- (18) The humerus sometimes wants the supracondyloid foramen.
- (19) The bone of the penis is small, save in *Cryptoprocta*.
- (20) The ears are not very long, erect, and pointed.
- (21) The tarsus and metatarsus are very often bald.
- (22) One plantar pad (small or large), and one beneath each digit.
- (23) Anus opening on the surface or in the middle of a saccular cutaneous invagination.
- (24) Anal glands from one to five pairs; generally one pair.
- (25) Very often prescrotal scent-glands.
- (26) Cæcum generally present and small or moderate, but occasionally absent.
- (27) No very hard, horny, sharp-pointed, conical papillæ on the dorsum of the tongue.
- (28) Hippocampal gyrus completely separated from that anterior internal portion of the superior lateral gyrus which is behind the crucial sulcus, by the continuation forwards of the callosomarginal sulcus to join the crucial sulcus.
- (29) The coronoid process of the mandible is almost, if not quite, always less lofty relatively, and less backwardly produced than in the *Felidæ*.

- (30) The proportional length of the limbs to the body is shorter than even in *F. eyra*.
- (31) The muzzle is large in proportion to the cranium.
- (32) The dentition may or may not be markedly sectorial.
- (33) The tail is almost always long, but may be short (*Cynogale*); but it is never so rudimentary as in the Lynxes.
- (34) Clitoris never traversed by urogenital canal.
- (35) Dorsal vertebræ never more than fourteen.
- (36) Postorbital processes generally developed, rarely enclosing orbit posteriorly.
- (37) Paroccipital processes depending or not.
- (38) Mastoid prominent or not.
- (39) There may be a conspicuous carotid foramen (deeply notching the sphenoid) in the basis cranii, for the entrance of the carotid into the cranial cavity.
- (40) Nose and upper lip generally medianly grooved, but not always so.
- (41) Palate not much, moderately, or much prolonged behind molars.
- (42) Pterygoid fossa present or absent.
- (43) Size of species generally moderate or small, sometimes very small—the smallest of the Æluroidæ.

The Hyænas form three well-marked species, whereof one (*crocuta*) is so much more distinct from its geographical ally (*H. brunnea*) than is the latter from the third form, *H. striata*, that I think it should rank as a distinct genus. *H. striata* is found in India, Persia, Asia Minor, and North Africa. The other two Hyænas are South-African only.

The anatomy of the genus (besides the notices in Cuvier and Meckel) has been given in part by Hunter ('Essays and Observations,' vol. ii. p. 57), by Cuvier and Daubenton (Hist. Nat. ix. p. 268, pls. 25-30), by Dr. Murie (Trans. Zool. Soc. vol. vii. p. 503, pl. 63), and by Dr. Watson (P. Z. S. 1877, p. 369, pls. 40 & 41; P. Z. S. 1878, p. 416, pls. 24 & 25; and P. Z. S. 1879, p. 79, pls. 5 & 6).

In *Hycæna* the muzzle is medianly grooved beneath. The hair is harsh and long, and forms a sort of mane along the middle of the back. There are but five digits either in front or behind. The legs are rather long, behind as well as in front. The tarsus and metatarsus are both hairy. Each foot has a single palmar or plantar naked pad, and one such pad to each toe. The claws are blunt and non-retractile, rather long, but not as we find them in the *Herpestina*. The body is either greyish or brownish, with blackish bands extending vertically on each side of the body and horizontally on the limbs, or is more or less uniformly brownish. The ears are erect and very long and pointed, such as exist in none of the *Felidæ* or *Viverridæ*. There is an anal pouch, with two (*H. striata*) or three¹ (*H. brunnea*) pairs of anal glands on each side of the rectum; and in one, if not

¹ Dr. Murie, *l. c.* p. 506.

in both species, there is a transverse band of isolated follicles at the bottom of the anal pouch.

The penis is long and pendulous, and entirely devoid of any bone. There are fifteen dorsal vertebræ.

The cranium of *Hyæna* differs from every Viverrine cranium by its enormous sagittal and lambdoidal ridges, and strong and greatly arched zygomata. The general type of its construction is Viverrine, though there is no alisphenoid canal or septum between the anterior and posterior portions of the auditory bulla. As to the first point, we have seen that the canal is generally wanting in *Viverricula*, and constantly so in the *Galidictinæ* and *Eupleres*. As to the auditory bulla, it is interesting to note that the aperture between the chambers is enlarged in the *Herpestinæ* (which by their circumanal pouch resemble the *Hyænidae*); and though there is no septum, yet I have detected in both species of *Hyæna*, inside the auditory bulla, two osseous ridges or laminæ, which if further developed would divide off a small anterior chamber from the much larger and externally more prominent posterior portion. The anterior portion of the margin of the external opening of the auditory meatus (which has no fissure or foramen in its floor) is much more produced than any other part—an exaggeration of a character we have already seen in the *Herpestinæ*. There is no pterygoid fossa. The postorbital processes are short and blunt, and widely separated from the malar processes. The skull is not pinched in behind them. The condyloid foramen is concealed. The paroccipital is long and depending. The mastoid is rather prominent. The carotid canal is much more Viverrine than Feline: its posterior opening is always larger, and generally situated much more anteriorly than in the *Felidæ*, and more approaching its situation in the *Viverrinæ*. There is no carotid foramen in the sphenoid; but it enters the cranium (beside the hinder end of the *sella turcica*) through the foramen lacerum, and covered in by the auditory bulla. The palate is much prolonged behind the last molars. The lower border of the mandible is much curved; the angle is flattened along its inferior border, and is pressed up nearer to the condyle than in *Felis* or in any other Æluroid I have seen—*Nandinia* (which also has rather strongly developed cranial ridges) being most like it in this respect, except, of course, *Crocuta* and *Proteles*.

The teeth of *Hyæna*¹ are so well known that I hesitate to re-describe them; but I feel any utility this paper may possess would be greatly impaired if their resemblances and differences to other Æluroids, and especially to the Cats, were not shortly noted in it.

The outer upper incisors are canine-like, and much more preponderant over the inner ones than in the Cats. The canines, on the other hand (both above and below), are relatively shorter, more flattened internally, and without longitudinal grooves either outside or inside. M.¹ is relatively larger than in *Felis* (though I have observed it to be

¹ Figured by De Blainville (Hyènes, pl. vi.) and Cuvier (Dents des Mamm. pl. 25). For osteology, see Cuvier's 'Ossements Fossiles,' 4th edition (1835), vol. vii. p. 311, and Atlas, vol. ii. pl. 190.

wanting in a specimen of *H. brunnea*). $P.^4$ is like the Cats', save that the anterior and posterior external cusps are nearly equal and more nearly approach in size the median external cusp, that the internal cusp is much larger and stouter, while the base of the antero-external angle of the tooth is not prominent. The antero-external fang is much more slender relatively, while the postero-external one and that of the internal tubercle are stouter. $P.^3$ differs from that of the Cats in its greater relative vertical and less antero-posterior development, and that its small talon seems never to be bilobed. Its basal ridge is much more developed within, and still more at the hinder part of the tooth. It has two very long roots, the anterior one of which is slightly the stouter. $P.^2$ differs from that of *Felis* (except that of *F. planiceps*) in having two roots; it is like $P.^3$, only smaller and less powerful. It is vastly more powerful than is $P.^2$ of *Felis*. $P.^1$ is close to (or almost close to) the canine; it is conical, with a basal ridge all round (much marked within and behind), and has a cutting-edge extending from the posterior outer to the antero-inner parts of the tooth. $P.^1$ is absent. $P.^2$ is much larger than $P.^1$, but smaller than $P.^2$; it is conical, but laterally compressed, with an antero-posterior cutting-edge, and a basal ridge all round it, but especially behind, where it develops a second, small tubercle. It is like the Cats' $P.^2$, but it is a little more vertically developed relatively, and is more quadrate when viewed from above. It has two subequal fangs. $P.^3$ is more caniniform; it differs from the Cats' in its large basal ridge, and has two large roots, the anterior of which is rather the larger. $P.^4$ has two fangs, the posterior of which is rather the larger; it is like the last tooth, save that its talon is larger and bears two tubercles side by side. It differs from the Cats' in its smaller talon and merely rudimentary anterior cusp. $M.^1$ is like that of the Cats; but the cusps are relatively shorter, and there is a talon which bears two small cusps; there is also a cusp within the more posterior of the two large cusps.

Comparing the milk-dentition of *Hyaena* with that of the Cats, I find that $D.^2$ has two roots; it is very like the Cats' $P.^3$, and therefore very unlike $D.^2$ of *Felis*. $D.^3$ (the milk sectorial) is very like the Cats' deciduous sectorial; but its inner tubercle is larger relatively; it is similarly situated. The deciduous outer incisors do not exceed the inner ones nearly so much as in the permanent dentition. $D.^2$ is just like the Cats' $D.^3$. $D.^3$ is like the Cats' $D.^3$, only larger relatively. $D.^4$ is very different from that of the Cats, because it has a very large talon with three small cusps as well, on and inside (and side by side with) the hinder principal cusp, half the size of the latter; it is a slight exaggeration of the permanent lower sectorial.

There is no supracondyloid foramen to the humerus. There is

only a rudimentary metacarpal or metatarsal bone for either pollex or hallux.

The genus *Crocuta*, instituted by Gray¹ for the Spotted Hyæna of South Africa, differs from the two species of true Hyænas as to coloration, and in that its ears are not so elongated and are rounded instead of pointed. The hind legs are shorter than the fore limbs; there is no dorsal mane; and there is but a single pair of anal glands, one on each side of the rectum, and a transverse band of follicles. The clitoris is enormous, and perforated by the urogenital canal², as has been excellently described in our 'Proceedings' by Dr. Watson³.

The cranium of *Crocuta* is like that of *Hyæna*, but that the incipient division between the two parts of the auditory bulla is more rudimentary. As to the dentition⁴, $\overline{M.1}$ has a quite minute rounded crown. $\overline{P.4}$ has antero-external cusp much smaller than the two other external cusps; $\overline{P.3}$ is very long, as is also $\overline{P.3}$; $\overline{P.4}$ has not two subequal tubercles side by side on its talon, there being the merest rudiment of the inner tubercle. $\overline{M.1}$ has no cusp inside the more posterior of its two large cusps; and its talon is quite minute.

The penis is large and pendulous, and boneless.

The dorsal vertebræ are fifteen in number.

The characters presented by the group of Hyænas—the subfamily *Hyæninæ*—are as follows:—

- (1) There is no pollex.
- (2) There is no hallux.
- (3) The ungual phalanges are not strongly arched.
- (4) The claws are but slightly arched, blunt, and not retractile.
- (5) The auditory bulla is inflated, and shows no external evidence of division.
- (6) The bulla is most prominent posteriorly, where it is not everted.
- (7) Only a rudiment of a bony septum.
- (8) The bony meatus auditorius is short; but its anterior lip is produced.
- (9) There is a carotid foramen not situated quite so far forward as in the *Viverridæ*.
- (10) There is no alisphenoid canal.
- (11) The palatine foramina are situated on the anterior half of the palate.
- (12) $\overline{P.1}$ and $\overline{P.2}$ are developed.
- (13) There is no $\overline{M.2}$ or $\overline{M.3}$.

¹ P. Z. S. 1868, p. 525.

² It may be interesting to note that, in the 'Journal of Anatomy and Physiology,' vol. xiv. (1879), p. 95, there is recorded (in a paper on the homology of the sexual organs) the case of a woman formed in the same way as is the female *Crocuta*.

³ P. Z. S. 1878, p. 416.

⁴ Figured by De Blainville; Cuvier, Ossem. Foss. ii. pl. 190; Gervais, Mamm. p. 97.

- (14) $\overline{M.1}$ is small and minute, occasionally absent.
- (15) The anterior and posterior external cusps of $\overline{P.4}$ are about equal, and nearly approach in size the median external one.
- (16) $\overline{M.1}$ has a large or small talon.
- (17) The outer incisors greatly exceed the middle ones.
- (18) The humerus wants the supracondyloid foramen.
- (19) The penis is boneless.
- (20) The ears are long, erect, and (with one exception) pointed.
- (21) The tarsus and metatarsus are entirely hairy.
- (22) There is one small plantar pad and one beneath each digit.
- (23) The anus opens into a sac.
- (24) The anal glands vary from one to three pairs.
- (25) There are no prescrotal scent-glands.
- (26) There is a moderate cæcum.
- (27) The tongue is furnished with large conical papillæ on its dorsum; but these are not hard as in the *Felidæ*.
- (28) The callosio-marginal sulcus joins the crucial sulcus.
- (29) Angle of mandible flattened along its inferior border, and pressed up nearer to the condyle, relatively, than in the *Felidæ*.
- (30) Proportional length of limbs longer than in *Viverridæ*.
- (31) Length of muzzle to cranium intermediate between *Viverridæ* and *Felidæ*.
- (32) Dentition extremely sectorial, while it is nevertheless formed for crushing.
- (33) Tail rather shorter, but not as in Lynxes.
- (34) The clitoris may be traversed by the urogenital canal.
- (35) Dorsal vertebræ not less than fifteen.
- (36) Postorbital processes short and blunt.
- (37) Paroccipital processes depending.
- (38) Mastoid rather prominent.
- (39) No carotid foramen in sphenoid.
- (40) Nose and upper lip medianly grooved.
- (41) Palate not much prolonged behind last molar.
- (42) No pterygoid fossa.
- (43) Enormous cranial ridges.

The genus *Proteles*, long known¹ as regards its skin and skeleton, had its anatomy first fully described by Professor Flower², who pointed out previously³ the characters of the basis crani, and its affinity, thus indicated, to the *Herpestinæ* and the *Hyæninæ*. Save for its greater slenderness, the animal has the general form of an *Hyæna*, with similarly long, erect, and pointed ears, and with a well-developed dorsal mane. There are five fore digits (though the pollex is short), but only four digits to the hind foot. There is a single

¹ First described in Sparman's 'Voyage to the Cape of Good Hope, 1772-1776.' See P. Z. S. 1869, p. 475.

² P. Z. S. 1869, p. 474, pl. 36, with various anatomical woodcuts.

³ P. Z. S. 1869, p. 28.

palmar or plantar pad, and one pad for each toe; and the tarsus and metatarsus are hairy. The nose is medianly grooved beneath. The fur is woolly, of a yellowish or reddish brown, with a few vertical black bands on the sides of the body, and others, more or less horizontal, on the limbs. The claws are blunt, non-retractile, and rather long. There is an anal pouch with one pair of anal glands, and a supraanal band of follicles, as in *Crocota*. The penis is boneless; and there are fifteen dorsal vertebræ.

As to the skull, its auditory bulla is (as Prof. Flower has pointed out) large, pyriform, and everted posteriorly as in *Herpestes*, divided by a septum into two chambers, one in front of the other. The margin of the external opening of the auditory meatus (which has no fissure or foramen in its floor) is most prominent anteriorly. There is no alisphenoid canal; the carotid canal is as in *Hyæna*; the paroccipital process is flattened, and does not depend; the mastoid is rather strongly prominent; the postorbital processes of the frontal are pointed and well developed; the skull is not pinched in behind them; the malar processes are moderately developed; the cranial ridges are weak; but the zygoma is rather strongly arched outwards; the condyloid foramen is concealed; the palate is very wide, and is considerably prolonged; and the pterygoid bones come very near the bullæ; the mesopterygoid fossa is very wide. The angle of the mandible is singularly flattened behind; and its apex is produced directly backwards. The hinder part of the horizontal ramus is bent up as in *Hyæna*.

The teeth, as is universally known, are quite abnormal and rudimentary. There are only three small, conical, blunt upper molars, whereof only $\frac{P. 3}{2}$ is two-rooted. There are only two lower molars, whereof only the hinder one is two-rooted.

Proteles agrees with the Hyænas in the characters just enumerated except Nos. 1, 5, 6, 7, 13, 15, 16, 17, 31, 32, 34, 36, 37, 41, and 43.

These characters, then, serve to differentiate the *Protelinæ* from the *Hyæninæ*.

The characters common to the whole family *Hyænidæ* will then stand as follows:—

- (1) There may or may not be a pollex; but in the majority of species there is not one.
- (2) There is never a hallux.
- (3) The ungual phalanges are never strongly arched; nor is there a wide lamina to shelter the base of the claw.
- (4) The claws are never more than slightly arched; they are blunt and non-retractile.
- (5) The auditory bulla is inflated, but generally gives no external indication of division.
- (6) The bulla entirely ankylosed into one mass, and is not more prominent towards its inner than towards its hinder border.
- (7) There is generally only a rudiment of a septum within the bulla.
- (8) The bony meatus auditorius is shorter, and has the anterior

part of its margin prolonged, but is never imperfectly ossified below.

- (9) A carotid foramen is visible on the inner side of the bulla, but is placed more posteriorly than in the *Viverridæ*.
- (10) There is no alisphenoid canal.
- (11) The palatine foramina are situated in the anterior half of the palate.
- (12) $\frac{P.1}{P.2}$ are developed.
- (13) There is never either $\frac{M.2}{M.2}$ or $\frac{M.2}{M.2}$.
- (14) $\frac{M.1}{M.1}$ is absent or small.
- (15) $\frac{P.4}{P.4}$ may abort; but if present, it has its anterior and posterior external cusps about equal and nearly approaching the median external cusp in size.
- (16) $\frac{M.1}{M.1}$ has a large or small talon, or is absent.
- (17) The outer incisors generally exceed greatly the inner ones, and are caniniform.
- (18) The humerus wants the supracondyloid processes.
- (19) The penis is boneless.
- (20) The ears are long, erect, and generally pointed.
- (21) The tarsus and metatarsus are entirely hairy.
- (22) There is one small plantar pad with four small pads for the digits of the pes.
- (23) The anus opens into a sac.
- (24) The anal glands vary from one to three pairs.
- (25) There are no prescrotal scent-glands.
- (26) There is a moderate cæcum.
- (27) The tongue is furnished with much-enlarged conical papillæ on its dorsum; but they are not placed as in the *Felidæ*.
- (28) The calloso-marginal sulcus joins the crucial sulcus.
- (29) The angle of the mandible is much flattened beneath.
- (30) Proportional length of the limbs larger than in the *Viverridæ*.
- (31) Length of muzzle to cranium generally intermediate between the conditions presented by the *Felidæ* and the *Viverridæ*.
- (32) Dentition extremely sectorial, and yet formed for crushing, or else altogether rudimentary.
- (33) Tail rather short, but not as in the *Lynxes*.
- (34) The clitoris may be traversed by the urogenital canal.
- (35) Dorsal vertebræ never less than fifteen.
- (36) Postorbital processes short and blunt or moderate; but orbits never enclosed by bone.
- (37) Paroccipital processes generally depending, but not always.
- (38) Mastoid rather prominent.
- (39) No carotid foramen in sphenoid.
- (40) Nose and upper lip medianly grooved.
- (41) Palate may or may not be much prolonged beyond the molars.
- (42) No pterygoid fossa.
- (43) Size of species always large.

The following tabular arrangement may be convenient for reference :—

	no $\overline{P.2}$; no alisphenoid canal; bulla not externally constricted, but internally divided; metatarsus entirely hairy; and 13 dorsal vertebrae. FELIDÆ. Claws completely retractile; inner cusp of upper sectorial moderate. Claws incompletely retractile; inner cusp of upper sectorial rudimentary.	<i>Felis.</i> <i>Cynælu- rus.</i>
ÆLUROIDEA: with	a $\overline{P.2}$; generally an alisphenoid canal; bulla externally constricted, and internally divided; metatarsus hairy or naked; and 13 or 14 dorsal vertebrae. VIVERRIDÆ.	
	a $\overline{P.2}$; no alisphenoid canal; bulla divided and constricted, or not so; metatarsus hairy; 15 dorsal vertebrae. HYÆNIDÆ.	
	almost always an alisphenoid canal and supracondyloid foramen; claws strongly curved and more or less retractile; bulla not posteriorly everted; large canines; generally prescrotal glands, and anus not opening into a sac. VIVERRINÆ.	
	No alisphenoid canal or supracondyloid foramen; claws moderately curved, not retractile; bulla posteriorly everted; large canines; no prescrotal glands; anus not opening into a sac. GALIDICTINÆ.	
Viverridæ: with	no alisphenoid canal; a supracondyloid foramen; claws elongated, not retractile; bulla hardly everted posteriorly; very small canines; no prescrotal glands; anus? EUPLERINÆ.	
	an alisphenoid canal; a large supracondyloid foramen; claws very curved and retractile; bulla not distinctly everted; large canines; no prescrotal glands; anus opening into a sac. CRYPTOPROCTINÆ.	
	an alisphenoid canal; a supracondyloid foramen; claws elongated, not retractile; bulla distinctly everted; large canines; no prescrotal glands; anus opening into a sac. HERPESTINÆ.	

VIVERRINÆ.

A. Upper lip medianly grooved, tail long.

I. Tarsus and metatarsus entirely hairy; ears

never tufted. $\overline{M.2}$ present *Viverra*.

$\overline{M.2}$ absent *Prionodon*.

II. Not so ; ears rarely tufted.

- a. A bald line on tarsus. $\frac{M. 2}{M. 2}$ present *Genetta*.
 $\frac{M. 2}{M. 2}$ absent *Poiana*.
 β. Two bald spots on tarsus *Fossa*.
 γ. Tarsus half bald ; auditory bulla only partly ossified *Nandinia*.
 δ. Tarsus half bald ; auditory bulla entirely ossified
 1. Back marked with transverse bands . . *Hemigalea*.
 2. Not marked with transverse bands.
 a. Teeth small ; hinder part of alveolar border of mandible everted *Arctogale*.
 b. Teeth not small ; hinder part of alveolar border not everted *Paradoxurus*.
 e. Tarsus absolutely naked ; ears tufted . . *Arctictis*.
 B. Upper lip not medianly grooved ; tail short . . *Cynogale*.

HERPESTINÆ.

A. Toes 5—5.

I. A groove beneath nose.

- a. Pm. $\frac{4}{4}$ *Herpestes*.
 β. Pm. $\frac{3}{3}$ *Helogale*.

II. No groove beneath nose.

- a. Tarsus hairy *Rhinogale*.
 β. Tarsus bald *Crossarchus*.

B. Toes 5—4. *Cynictis*.

C. Toes 4—4.

- a. A groove beneath nose *Bdeogale*.
 β. No groove beneath nose *Suricata*.

GALIDICTINÆ.

A. Inferior canine very large *Galidictis*.

B. Inferior canine not very large.

- I. $\frac{P. 1}{P. 1}$ absent ; $\frac{M. 2}{M. 2}$ very small *Galidia*.

- II. $\frac{P. 1}{P. 1}$ present ; $\frac{M. 2}{M. 2}$ of moderate size *Hemigalidia*.

Distribution of the Æluroidæ.

The suborder extends (apart from the arctic and antarctic regions) over the whole world except Australia, New Guinea, New Zealand, Polynesia, and the Antilles—extending even into the Moluccas, Philippines, Celebes, and Madagascar.

The family *Felidæ* is almost as cosmopolitan as is the entire suborder, but it is not found in the Moluccas, Philippines, Celebes, or Madagascar. It alone of the Æluroidæ extends into the New World ; but, as was long ago remarked by Buffon, the Cats of the Old and New Worlds are markedly distinct. Only one species, the northern *Lynx*, is common to both worlds.

The Asiatic and African Cats are distinct, except the Lion, Leopard, Caracal, and Chetah. Twenty-six species seem to be peculiar to Asia, and only six to Africa. Ten species are peculiar to America.

The Indian archipelago is very rich in species; and the island of Bali seems their extreme limit. The Tiger is found there. Two species of *Lynx* and the Wild Cat are European.

The *Hyænidæ* are almost entirely African, and three of its five species South-African. *H. striata* alone extends into Western Asia and Northern Africa.

The family *Viverridæ* is exclusively confined to the Old World, and has but two representatives—a Genet and an Ichneumon (*Genetta vulgaris* and *Herpestes ichneumon*)—in Europe.

Apart from the Ichneumons and Paradoxures, twelve species are Asiatic and twenty African. The Ichneumons are divided, as before-said, into thirteen Asiatic and seven African. The Paradoxures are all Asiatic, but are not well defined as to species; if we accept provisionally the number (twelve) of Dr. Gray¹, that will give a total of thirty-seven Asiatic forms of *Viverridæ*, and thirty-two African forms. Besides these, eight species are found in Madagascar.

No species is common to Asia and the continent of Africa, except *Genetta vulgaris* and *Herpestes ichneumon*.

No species appears to be common to Madagascar and the continent of Africa, a species of *Crossarchus* found there having been probably introduced by man.

No species is common to Madagascar and Asia except *Viverricula*, that wandering Jew amongst the *Viverridæ*, the extensive range of which has been already indicated².

The other Madagascar species are *Fossa*, *Eupleres*, and the four species of *Galidictinæ* and *Cryptoprocta*.

Thus Madagascar, containing as it does examples of all five sub-families of *Viverridæ*, has by far the most peculiar Viverrine fauna of the whole world.

Next to it comes Borneo, with its *Prionodon*, *Arctictis*, *Cynogale*, *Hemigalea*, *Paradoxuri*, and *Herpestes*; and the Indian Archipelago generally is rich in Viverrine life as well as being inhabited by the Cats *F. macrocelis*, *F. marmoratus*, *F. planiceps*, and *F. badia*.

The Viverrine section of the subfamily *Viverrinæ* are pretty equally divided between Asia and Africa; with the exception of the West-African *Nandinia*, the paradoxurine section of the *Viverrinæ* are entirely Asiatic.

As a rule the *Viverrinæ* as to species are predominantly Asiatic, while the *Herpestinæ* are predominantly African, and especially South-African. As regards genera, the *Viverrinæ* have six genera peculiar to Africa, and one to Madagascar, while three (*Viverra*, *Viverricula*, and *Genetta*) are common to both the continents.

As regards genera, the subfamily *Herpestinæ* has no less than six peculiar to Africa, and not one Asiatic genus which is not also found in Africa, the only genus common to the two continents being *Herpestes*.

¹ Cat. of Carnivora in Brit. Mus., p. 63.

² See ante, p. 149.

It is interesting to note that the genera of *Viverridæ* with numerous anal glands and a large circumanal pouch are African, and especially South-African, like *Hyæna brunnea*.

The extreme geographical limits of the *Viverridæ* seem to be France, Spain, Shanghai, Formosa, the Philippines, Celebes, Lombok, Madagascar, the Cape, and the north-western part of Africa—Cape Verd.

The most northern range in the continent of Asia appears to be that of *Hyæna striata* in Asia Minor¹.

No species of the *Viverridæ* is so widely diffused as is *Viverricula*.

Geographically, then, as well as in some respects structurally, the *Viverridæ* (apart from the Madagascar forms) seem to divide themselves into two great sections—one Asiatic and Viverrine, the other African and Herpestine.

The *Æluroidæ* being considered as one whole, and Dr. Gray's twelve species of *Paradoxurus* and my enumeration of Cats being provisionally accepted, we have a total of 5 species of *Æluroids* in Europe, 7 species in Madagascar, 11 species in America (all Cats), 46 species in Africa, and 68 in Asia, 7 of these being common to both Africa and Asia.

Before long I hope to lay before the Society my notes on some parts of the anatomy, and especially on the osteology of the *Æluroidæ*.

2. On some Points in the Anatomy of the Indian Darter (*Plotus melanogaster*), and on the Mechanism of the Neck in the Darters (*Plotus*), in connexion with their Habits. By W. A. FORBES, B.A., Prosector to the Society.

[Received January 9, 1882.]

It is to the late Prof. Garrod that we are indebted for our knowledge of the great differences in the anatomy of the digestive organs of the American² (*Plotus ankinga*), and African³ (*P. levaillanti*) Darters. The existence of such differences in birds apparently so nearly allied made it very desirable to obtain a knowledge of these parts in the other species of the genus *Plotus*.

On April 8th last, the Society obtained, by exchange from the Zoological Gardens of Calcutta, the first specimen of the Indian Darter (*Plotus melanogaster*) that it has acquired. The specimen, a

¹ P. de Tchihatcheff in his 'Asie Mineure' (1856), 2^e partie, p. 602, reports good evidence of its existence in Asia Minor. He says:—"Je ne l'ai jamais observée à l'état vivant, mais dans plusieurs localités de la Phrygie, de la Mysie et du Pont, les habitants m'en ont positivement constaté l'existence; d'ailleurs à Selevké (littoral de la Cilicie pétrée); une dépouille de la *Hyæna striata* me fut montrée par un chasseur Arménien qui m'assura d'avoir tué l'animal dans les montagnes voisines."

² P. Z. S. 1876, pp. 335-345; Scient. Papers, pp. 334-346, pls. xviii.-xx.

³ L. c. 1878, pp. 679-681; t. c. pp. 346-349.